

APPENDIX A
CLAIM SUPPORT IN
APPLICATION NO. 09/385,812

<p>89. An intermammary artery access retractor comprising;</p>	<p>See, e.g., figures 13-23, 26, 28-34, 39, 40, 66-70.</p> <p>page 1, lines 15-17: "This invention relates to retractors, and more particularly to an access platform that facilitates access to the interior of the chest cavity during surgical procedures;"</p> <p>page 8, lines 14-16: "The access platform of the present invention serves to facilitate the dissection of an internal mammary artery (IMA), including both proximal and distal dissection;"</p> <p>page 18, lines 12-17: "Referring now in detail to the drawings, therein illustrated are novel embodiments of an access platform that facilitates the dissection of an internal mammary artery (IMA), including both proximal and distal dissection, and access to the heart during a "beating heart" Coronary Artery Bypass Graph (CABG) procedure by increasing the surgeon's working space and visual access;"</p> <p>page 18, line 23-page 19, line 3: "Turning to Figure 1, the access platform 10 incorporating a preferred embodiment of the present invention, is shown disposed over the outline of a patient's chest P. An incision in the patient's chest P adjacent to the LIMA (shown in phantom) exposes an LAD artery on the exterior of the patient's heart."</p>
<p>a frame having a crossbar, a fixed retractor arm and a movable retractor arm, said movable arm being movable toward or away from the fixed arm;</p>	<p>See, e.g., page 19, lines 4-23: "Preferably, the access platform 10 comprises a pair of blades 50 and 51, a pair of support pads 80 and 81, a pair of tissue retractors 70 and 71, a pair of torsional members 30 and 31, and a spreader member 12. The torsional members 30 and 31 and the spreader member 12 preferably extend away from the blades 50 and 51 and the tissue retractors 70 and 71 and, thus, the chest incision, in a plane relatively parallel to the patient's chest. As a result, the access platform 10 advantageously maintains a low profile that remains substantially clear of the surgeon's working space.</p> <p>Referring to Figure 2, the components of the access platform 10 are shown less the tissue retractors 70 and 71. The spreader member 12 preferably comprises a rotatable hub 14 including operably coupled upper and lower hub halves 17 and 16. A pair of spreader arms 19 and 18 extend from the upper and lower hub halves 17 and 16, respectively, and connect to the torsional members 31 and 30, respectively. Preferably, the hub 14 includes a harmonic gear drive 20 used to rotate the upper hub half 17 relative to the lower hub half 16 and, thus, spread or close the spreader arms 18 and 19 to retract or relax the patient's ribs;"</p> <p>page 21, line 13-page 22, line 2: "Blade arms 56 and 57 interconnect the blades 50 and 51 to the rest of the access platform 10. The blade arms 56 and 57 comprise stems 62 and 63 received in sockets 34 and 35 in torque bases 32 and 33. The sockets 34 and 35 and the stems 62 and 63 are constructed such that the blade arms 56 and 57 are releasably connected to the torque bases 32 and 33. The stems 62 and 63, which extend relatively horizontally from the torque bases 32 and 33, include pivot sections 60 and 61 extending therefrom. Branches 58 and 59 extend outwardly and downwardly away from the pivot sections 60 and 61 and are attached to the throats 54 and 55 of the blades 50 and 51. This blade arm construction advantageously directs the bulk of the access platform 10 away from the surgeon's working area;"</p>

page 32, lines 14-20: " A second embodiment of the access platform 110 is shown in Figures 13, 14 and 15. The second embodiment of the access platform 110 includes a spreader member 112 preferably comprising a horizontally disposed rack 120 and pinion housings 121 and 122 slidably disposed over the rack 120. The pinion housings 121 and 122 rotatably retain pinions 123 and 124 driven by levers 125 and 126;"

page 33, lines 6-14: " The blade arms 146 and 147 further comprise pivot sections 150 and 151 extending horizontally from the stems 152 and 153. Branches 148 and 149 extend downwardly and outwardly from the pivot sections 150 and 151 of the blade arms 146 and 147 to position the remainder of the access platform 110 away from the surgeon's working area. Branches 148 and 149 attach to blades 140 and 141. The blades 140 and 141 comprise elongated vane sections 142 and 143 extending outwardly from recessed throat sections 144 and 145;"

page 36, line 22-page 37, line 11: " A third embodiment of the access platform 210 is shown in Figures 16 and 17. The third embodiment of the access platform 210 includes a spreader member 212 comprising a horizontally-disposed rack 214 and pinion housings 216 and 218 slidably disposed over the rack 214. Pinions 220 and 222 are rotatably retained in the pinion housings 216 and 218 and driven by levers 224 and 226.

Blades 230 and 231 comprise elongated vane sections 232 and 233 extending from recessed throat sections 234 and 235. Blade arms 236 and 237 have branches 238 and 239 that extend downwardly and outwardly from horizontally disposed stems 240 and 241 and connect to the blades 230 and 231. The stems 240 and 241 of the blade arms 236 and 237 are releasably received in sockets 217 and 219 formed in the pinion housings 216 and 218;"

page 38, line 15-page 39, line 18: "A fourth embodiment is shown in Figure 18. The access platform 310 of the fourth embodiment includes a spreader member 312 comprising a rack 320, a housing 322 slidably received over the rack 320, a pinion 324 rotatably retained in the housing 322 and a lever 326 connected to the pinion 324. A spreader base 328 is attached to one end of the rack 320. A pair of parallel spaced fingers 330A and 330B extend from the housing 322. Similarly, a pair of parallel spaced fingers 332A and 332B extend from the spreader base 328 and are positioned parallel to the fingers 330A and 330B extending from the housing 322.

A pair of blade arms 338 and 340 include branch sections 346 and 348 that extend downwardly from central portions 339 and 341 and connect to blades 350 and 352. Stem portions 342 and 344 extend from the central portions 339 and 341 opposite the branch sections 346 and 348. The stem 342 extends between and is pivotally mounted to fingers 330A and 330B at a pivot 331. Likewise, stem 344 extends between and is pivotally mounted to fingers 332A and 332B at a pivot 333. As a result, the blade arms 338 and 340 rotate about an axis of rotation A₁ that is parallel to the rack 320. This construction advantageously enables the access platform 310 to address a thoracotomy positioned anywhere along the chest wall without intruding on the surgeon's working space. If the thoracotomy is located on the lateral side of the chest wall the spreader member 312, the spreader base 328 and the housing 322 are simply pivoted away from the surgeon's working space;"

page 39, line 22-page 40, line 17: "a fifth embodiment of the access platform 310 modifies the fourth embodiment shown in Figure 18 to include a pair of links 360 and 362 interposed and hingedly interconnected to the blade arms 338 and 340 and the housing 322 and spreader base 328, respectively. The links 360 and 362 comprise link bodies 364 and 366 and parallel spaced fingers 368A and 368B and 369A and 369B, respectively, extending from the link bodies 364 and 366. The link bodies 364 and 366 extend between and pivotally mount to the fingers 330A and 330B and 332A and 332B at pivots 331 and 333, respectively. Likewise, the stems 342 and 344 of the blade arms 338 and 340 extend between and pivotally mount to the fingers 368A and 368B and 369A and 369B at pivots 363 and 365, respectively. As a result, the blade arms 338 and 340 and the links 360 and 362 rotate about parallel axes of rotation A_1 and A_2 that are parallel to the rack 320. This construction further enables the access platform 310 to address a thoracotomy positioned anywhere along the chest wall without intruding on the surgeon's working space by easily pivoting the spreader base 328, the housing 332 and the rack 320 out of the surgeon's way;"

page 42, lines 3-19: "A sixth embodiment of the access platform 310 is shown in Figure 22 to comprise a combination of components from the first and fourth embodiments (Figures 2 and 18). More particularly, the torsional members 30 and 31 of the first embodiment are interposed between and operably connected to the fingers 330A and 330B and the housing 322, and interposed between and operably connected to the fingers 332A and 332B and the spreader base 328, respectively. In addition, the support pads 80 and 81 of the first embodiment are adjustably attached to the fingers 330A and 330B, 332A and 332B. By including the torsional members 30 and 31 and the support pads 80 and 81, second and third axes of rotation A_2 and A_3 are provided. Thus, as in the first embodiment, the torsional members 30 and 31 enable the access platform 310 to vertically displace the blades 350 and 352 and the retracted ribs. To vertically displace the blades 350 and 352, the blade arms 338 and 340 are fixedly coupled to the fingers 330A and 330B, 332A and 332B by pins 334 and 336.;"

page 42, line 20- page 43, line 21: "Turning to Figure 23, a seventh embodiment of the access platform is shown to comprise a modification of the fifth embodiment of the access platform shown in Figure 19. The access platform 310 in Figure 23 includes an offset assembly 308 interconnected to the blades 350 and 352. The offset assembly 308 comprises lead screws 313 and 314 extending between the blades 350 and 352 and further operably interconnecting the blades 350 and 352. At a first end, the lead screws 313 and 314 are rotatably captured by capture mounts 317 and 318. The capture mounts 317 and 318 are fixed to the blade 350. The threaded portion of the lead screws 313 and 314 threadably passes through a pair of lift mounts 315 and 316. The lift mount 315 is affixed to the blade arm 340 which is interconnected to the superior blade 352. The lift mount 316 is affixed to the top of a lift mount arm 319 extending vertically from the superior blade 352 to a height which is level with the lift mount 315 on the blade arm 340. Levers 309 and 311, which are attached to a second end of the lead screws 313 and 314, are used to rotate the lead screws 313 and 314 to drive the lift mounts 315 and 316 thereon. With the horizontal distance between the inferior and superior blades 350 and 352 adjustably fixed by the spreader member 312, the offset assembly 308 is only able to vertically displace the blade 352 relative to the blade 350. Thus, depending on the direction of rotation of the lead screws 313 and 314, the superior blade 352 will be raised or lowered to offset it relative to the inferior blade 350;"

page 45, line 3-page 46, line 5: "Turning to Figure 26, a ninth embodiment of the access platform 410 of the present invention is shown. The access platform 410 mounts to the table or rail via slides 438 and 440 that are locked in place by positioners 450 and 452. The slides 438 and 440 rotatably retain pinions 442 and 444 driven by levers 446 and 448 and slidably receive stanchion racks 430 and 432. The stanchion racks 430 and 432 include rack gears 434 and 436 that operably couple with pinions 442 and 444. The levers 446 and 448 are rotated to drive the pinions 442 and 444 along rack gears 434 and 436 to adjust the height of the stanchion racks 430 and 432 relative to the table or patient, or to vertically offset blades 470 and 472 relative to one another.

A pinion housing 422 is slidably attached to the stanchion rack 432 towards its upper end. A rack 420 is attached at one end to stanchion rack 430 and is slidably received in the pinion housing 422. A pinion 424 driven by a lever 426 is rotatably retained in the pinion housing 422 and operably connected to the rack 420. The lever 426 is rotated to drive the pinion 424 along the rack 420 to spread apart the stanchion racks 430 and 432 and effectively a patient's ribs.

Torsional members 460 and 462 are attached to the top of the stanchion racks 430 and 432. Blade arms 474 and 476 extend outwardly from torsional members and attach to the blades 470 and 472. The torsional members comprise inner hubs 461 and 465 rotatably received in and operably connected to outer hubs 463 and 467. Locking levers 464 and 466 lock the inner hubs 461 and 465 in place relative to the outer hubs 463 and 467.

In operation, the access platform 410 is positioned such that the blades 470 and 472 can be inserted into an incision in a patient's chest and then attached to the blade arms 474 and 476. Once the blades 470 and 472 are positioned in the incision and attached to the blade arms 474 and 476, the lever 426 is rotated to spread the blades 470 and 472 and the patient's ribs apart. The blades 470 and 472 can be effectively offset by rotating the inner hubs 461 and 465 relative to the outer hubs 463 and 467. While the blades 470 and 472 are rotated, the stanchion racks 430 and 432 can be raised or lowered by rotating levers 486 and 488 to drive pinions 442 and 444. By raising or lowering the stanchion racks 430 and 432, the blades 470 and 472 can be effectively raised or lowered relative to one another to further offset the blades 470 and 472 relative to one another. A wrench 468 is utilized to rotate the inner hubs 461 and 465 relative to the outer hubs 463 and 467;"

page 48, lines 1-11: "Turning to Figure 28, an eleventh embodiment of the access platform 651 comprises a spreader housing 602 that includes a drive mechanism therein (not shown) and a drive slot 608 formed therein. A spreader lever 604 is mounted on top of the spreader housing 602 and is operably connected to the drive mechanism housed therein. An inferior blade 650 is interconnected to the drive mechanism via a blade arm 640 which extends outwardly to the inferior blade 650 from the spreader housing 602 in a direction generally normal to the housing 602. A tissue retractor 670 is attached to the blade 650 to assist in tissue retraction;"

page 50, line 17-page 51, line 9: "Referring to Figure 29, a twelfth embodiment of an access platform 659 is shown to comprise a modification of the eleventh embodiment of the access platform 651 shown in Figure 28. The offset assembly 690 of the access platform includes an offset housing 691 extending upwardly from the spreader housing 602 and adapted to slidably receive a curved rack 692. The blade arm 642 is attached to the curved rack 692 through a slot 699 in the housing 691. A worm gear 693 is positioned within the housing 691 and is operably connected to the curved rack 692. A worm gear shaft 689 extends from the worm gear 693 and connects to a lever 694 outside of the housing 691. Thus, to lift the superior blade 652 and ribs, the lever 694 is rotated in an appropriate direction to rotate the worm gear 693 to drive the curved rack 692 upwardly and outwardly from the housing 691. To lower the superior blade 652 from the offset position, the lever 694 is reverse rotated to drive the curved rack 692 in an opposite direction;"

page 51, line 10-page 52, line 20: " Turning to Figure 30, a thirteenth embodiment of the access platform 655 of the present invention comprises a generally elongated drive base 601 having a blade arm 640 and a pad arm 683 extending therefrom. The blade arm 640 extends in a generally normal direction from the drive base 601, while the pad arm 683, which is generally arcuately shaped, extends longitudinally and downwardly from the drive base 601. The pad arm 683 terminates in a sternal pad 681. A threaded shaft carrier 607 extends upwardly from the drive base 601 adjacent the blade arm 640. An inferior blade 650 having a tissue retractor 670 extending therefrom attaches to the blade arm 640. In a preferred construction, the inferior blade 650, tissue retractor 670, blade arm 640, threaded shaft carrier 607, drive base 601, pad arm 683, and sternal pad 681 are formed from one-piece construction.

A hollow threaded shaft 603 is threaded through the shaft carrier 607 and extends along the drive base 601 to rotatably attach to a hollow drive block 609. A spreader handle 605 is attached to the shaft 603 at an end opposite the drive block 609. A worm gear 697 positioned in the drive block 609, is fixed to the end of a shaft 696 that passes through the hollow threaded shaft 603 and attaches to an offset handle 695 beyond the spreader handle 605. The worm gear 697 is operably connected to an arcuate worm gear rack 698 that is positioned within the drive block 609 and connected to a branch 643 of a blade arm 642. The branch 643 of the blade arm 642 extends from the blade arm 642 in a normal direction and is pivotally mounted to the hollow drive block 609. The blade arm 642 extends downwardly from the branch 643 and attaches to a superior blade 652 with a tissue retractor 672 extending therefrom. A follower 619 extends downwardly from the base of the hollow drive block 609 and is received in a elongated drive slot 611 in the drive base 601. As the drive block 609 is transversely driven along the base 601 by the threaded shaft 603, the follower 609 slidably follows the drive slot 611 in the drive base 601;"

page 54, line 16-page 55, line 19: "Referring to Figures 31 and 32, a fourteenth embodiment of the access platform 610 of the present invention comprises a spreader component 612 that includes a rack 613, a spreader base 614 attached to one end of the rack 613 and a pinion housing 620 slidably received over the rack 613. A pinion 621 that is driven by a lever 622 is rotatably retained in the pinion housing 620 and operably connected to the rack 613.

A fixed pivot 616 having a socket 618 formed therein, extends from the spreader base 614. A fixed pivot lock 615 with a lock screw 617 is fixedly connected to the fixed pivot 616. A moveable pivot 624 having a socket 625 formed therein, extends from the housing 620. Rotatably and releasably received in and extending from the sockets 618 and 625 are stem portions 644 and 646 of a pair of blade arms 640 and 642, respectively. The stem 644 that is received in the socket 618 of the fixed pivot 616 includes a stop 645 formed on its exterior to abut the fixed pivot lock 615 and stop the travel of the stem 644. Branch portions 641 and 643 of the blade arms 640 and 642 extend downwardly from the stem portions 644 and 646 and attach to inferior and superior blades 650 and 652, respectively. The superior blade 652 which is advantageously located below and interconnected to the moveable pivot 624, comprises a recessed throat 654 to capture a rib adjacent to an incision in the patient's chest cavity and a pair of elongated vanes 656 and 657 used to offset a plurality of the patient's ribs. The inferior blade 650 which is interconnected to the fixed pivot 616 comprises a recessed throat 653 used to capture a rib adjacent to an incision in the patient's chest cavity;"

page 56, lines 3-13: " The branch portion 643 of the blade arm 642 that is interconnected to the moveable pivot 624 extends higher vertically than the branch portion 641 of the blade arm 640 that is interconnected to the fixed pivot 616 when the blades 650 and 652 are substantially level (see Figure 29). This construction tends to increase the moment about the moveable pivot 624 caused by the offset of the movable pivot from the center-of-effort of the spreading force at the blades 650 and 652. Because the movable pivot 624 is located above the superior blade 652, a lifting force is naturally exerted on the superior blade 652 and ribs as spreading occurs;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 64, line 5-page 67, line 5: " Referring to Figure 39, a sixteenth embodiment of an access platform 780 comprises a generally elongated drive base 781 having a blade arm 782 extended generally in a normal direction from the drive base 781. A generally arcuate pad arm 786 extends generally longitudinally and downwardly from the drive base 781 and terminates at a sternal pad 785. A bearing support 791 extends upwardly from the drive base 781 adjacent the blade arm 782. An inferior blade 783 having a tissue retractor 784 extending therefrom attaches to the end of the inferior blade arm 782. In a preferred construction, the inferior blade 781, tissue retractor 784, blade arm 782, bearing support 791, drive base 781, pad arm 786 and sternal pad 785 are formed from one-piece construction.

A bearing 792 is mounted to the bearing support 791 and has a spreader handle 793 operably coupled thereto. A drive screw 787 having an offset handle 794 with a lever 795 attached to its first end, is threaded through the spreader handle 793 and freely passes through the bearing 792 and bearing support 791. The drive screw 787 extends longitudinally along the drive base 781 and is threaded through a carrier mount 789. The spreader handle 793 and the carrier mount 789 include oppositely wound threads. Rotation of the spreader handle 793 transversely drives the drive screw 787 and the carrier mount 789 mounted thereon along the drive base 781 and, thus, spreads or closes the blades 783 and 796. The carrier mount 789 includes a follower extending downwardly from its base that inserts into a drive slot 788 in the base 781. As the carrier mount 789 is translated across the drive base 781, the follower slides along the drive slot 788.

Extending upwardly and longitudinally outwardly in a direction away from the spreader handle 793, a carrier arm 790 extends from the carrier 789. At an end opposite the carrier mount 789, the carrier arm 790 pivotally captures at a pivot 799 a branch 797A of a blade arm 797. A tab 779 is fixed to the branch 797A adjacent the pivot 799 and extends downwardly in a direction normal to the branch 797A. The tab 779 contacts a shaft-end 787A of the drive shaft 787 opposite the offset handle 794 and extending beyond the carrier 789. The branch 797A extends outwardly from the pivot 799 in a normal direction to the carrier arm 790 and couples to the blade arm 797 at an end opposite the carrier arm 790. The blade arm 797 is generally arcuately shaped and extends downwardly from the branch 797A to connect to a superior blade 796 with a tissue retractor 798 extending therefrom. Because the pivot 799 is located above the superior blade 796, a lifting force is exerted on the superior blade 796 and ribs as a spreading force from the inferior blade 783 is transmitted to the superior blade 796 through the pivot 799.

Rotation of the offset handle 794, while holding the spreader handle 793 stationary, will thread the drive screw 787 through both the spreader handle 793 and the carrier 789, and thereby cause the drive screw 787 and carrier 789 to traverse the drive base 781 as well as causing the carrier 789 to traverse the drive screw 787 in the same direction. As a result, the carrier 789 traverses the drive base 781 at approximately two-times the speed that the carrier 789 traverses the drive screw 787 and thus, the length of the shaft-end 787A extending beyond the carrier 789 will increase or decrease at approximately one-half the speed at which the carrier 789 traverses the drive base 781. Therefore, as the offset handle 794 is rotated in a direction to spread the ribs, the ribs will be raised at a rate slower than they are spread as the superior blade 796 naturally rotates about the pivot 799 as the length of the shaft-end 787A extending beyond the carrier 789 decreases. Similarly, as the offset handle 794 is rotated in a direction to lower the offset ribs, the length of the shaft-end 787A will increase, at a rate slower than the rate at which the carrier 789 traverses the drive base 781. As the length of the shaft end 787A increases, it forces the tab 779, and thus the superior blade 797, to rotate in the counterclockwise direction around the pivot 799, and thereby further lowers the ribs. Because the carrier 789 traverses the drive base 781 at a faster rate than the shaft-end 787A increases, the distance between the blades 783 and 796 along the drive base 781 tends to decrease as the ribs are lowered;"

page 70, line 3-page 71, line 10: "Turning to Figure 40, a seventeenth embodiment of the access platform 800 comprises a spreader housing 801 which includes a drive mechanism housed therein (not shown) and a drive slot 803 cut into the spreader housing 801. A spreader lever 802 is mounted on the top of the spreader housing 801 and is operably connected to the drive mechanism housed therein. An inferior blade 805 having a tissue retractor 804 extending therefrom, is interconnected to the drive mechanism via a blade arm 806. The blade arm 806 extends outwardly from the spreader housing 801 in a generally normal direction.

A pad arm 817 connects at one end, or is formed integrally therewith, to the spreader housing 801 and extends outwardly therefrom. A sternal pad 816 is integrally formed on the pad arm 817 at an end opposite the housing 801. The pad arm 817 is generally arcuate to conform to an extended rib cage due to the offset of the ribs.

A superior blade 820 having a tissue retractor 821 extending therefrom, is connected to the bottom end of a generally arcuately shaped blade arm 818. The top end of the blade arm 818 is pivotally mounted on an offset stanchion 815 that extends upwardly from the pad arm 817. A compression member 813 is pivotally connected to the top of the stanchion 815 at pivot 814 and extends inwardly from the stanchion 815 toward the lever 802 on the spreader housing 801. An offset screw 811 having a handle 812 attached to its top end, is threaded through the compression member 813 at an end opposite the pivot 814 and is rotatably captured by a bushing assembly 808 rotatably coupled to a mount 807 that extends upwardly from the spreader housing 801. A counter-lift tab 809 extends inwardly from the blade arm 818 adjacent the stanchion 815. The lift tab 809 is operably connected to the compression member 813 through an offset spring 810 mounted therebetween;"

<p>a standard retractor blade mounted on said fixed arm;</p>	<p>See, e.g., page 19, lines 4-7: " Preferably, the access platform 10 comprises a pair of blades 50 and 51, a pair of support pads 80 and 81, a pair of tissue retractors 70 and 71, a pair of torsional members 30 and 31, and a spreader member 12;"</p>
	<p>page 21, lines 6-12: " Referring to Figure 2, the blades 50 and 51 preferably include elongated vanes 52 and 53, which slide beneath a plurality of the patient's ribs, and recessed arcuate throats 54 and 55 that receive the patient's ribs that are adjacent to the chest incision. The benefits of the recessed throats 54 and 55 and the elongated vanes 52 and 53 will be discussed below with regard to the operation of the access platform 10;"</p>
	<p>page 33, lines 6-14: " The blade arms 146 and 147 further comprise pivot sections 150 and 151 extending horizontally from the stems 152 and 153. Branches 148 and 149 extend downwardly and outwardly from the pivot sections 150 and 151 of the blade arms 146 and 147 to position the remainder of the access platform 110 away from the surgeon's working area. Branches 148 and 149 attach to blades 140 and 141. The blades 140 and 141 comprise elongated vane sections 142 and 143 extending outwardly from recessed throat sections 144 and 145;"</p>
	<p>page 39, lines 3-5: " A pair of blade arms 338 and 340 include branch sections 346 and 348 that extend downwardly from central portions 339 and 341 and connect to blades 350 and 352;"</p>
	<p>page 42, lines 3-19: "A sixth embodiment of the access platform 310 is shown in Figure 22 to comprise a combination of components from the first and fourth embodiments (Figures 2 and 18). More particularly, the torsional members 30 and 31 of the first embodiment are interposed between and operably connected to the fingers 330A and 330B and the housing 322, and interposed between and operably connected to the fingers 332A and 332B and the spreader base 328, respectively. In addition, the support pads 80 and 81 of the first embodiment are adjustably attached to the fingers 330A and 330B, 332A and 332B. By including the torsional members 30 and 31 and the support pads 80 and 81, second and third axes of rotation A_2 and A_3 are provided. Thus, as in the first embodiment, the torsional members 30 and 31 enable the access platform 310 to vertically displace the blades 350 and 352 and the retracted ribs. To vertically displace the blades 350 and 352, the blade arms 338 and 340 are fixedly coupled to the fingers 330A and 330B, 332A and 332B by pins 334 and 336.;"</p>

page 42, lines 20-page 43, line 21: "Turning to Figure 23, a seventh embodiment of the access platform is shown to comprise a modification of the fifth embodiment of the access platform shown in Figure 19. The access platform 310 in Figure 23 includes an offset assembly 308 interconnected to the blades 350 and 352. The offset assembly 308 comprises lead screws 313 and 314 extending between the blades 350 and 352 and further operably interconnecting the blades 350 and 352. At a first end, the lead screws 313 and 314 are rotatably captured by capture mounts 317 and 318. The capture mounts 317 and 318 are fixed to the blade 350. The threaded portion of the lead screws 313 and 314 threadably passes through a pair of lift mounts 315 and 316. The lift mount 315 is affixed to the blade arm 340 which is interconnected to the superior blade 352. The lift mount 316 is affixed to the top of a lift mount arm 319 extending vertically from the superior blade 352 to a height which is level with the lift mount 315 on the blade arm 340. Levers 309 and 311, which are attached to a second end of the lead screws 313 and 314, are used to rotate the lead screws 313 and 314 to drive the lift mounts 315 and 316 thereon. With the horizontal distance between the inferior and superior blades 350 and 352 adjustably fixed by the spreader member 312, the offset assembly 308 is only able to vertically displace the blade 352 relative to the blade 350. Thus, depending on the direction of rotation of the lead screws 313 and 314, the superior blade 352 will be raised or lowered to offset it relative to the inferior blade 350;"

page 45, line 3-page 46, line 5: "Turning to Figure 26, a ninth embodiment of the access platform 410 of the present invention is shown. The access platform 410 mounts to the table or rail via slides 438 and 440 that are locked in place by positioners 450 and 452. The slides 438 and 440 rotatably retain pinions 442 and 444 driven by levers 446 and 448 and slidably receive stanchion racks 430 and 432. The stanchion racks 430 and 432 include rack gears 434 and 436 that operably couple with pinions 442 and 444. The levers 446 and 448 are rotated to drive the pinions 442 and 444 along rack gears 434 and 436 to adjust the height of the stanchion racks 430 and 432 relative to the table or patient, or to vertically offset blades 470 and 472 relative to one another.

A pinion housing 422 is slidably attached to the stanchion rack 432 towards its upper end. A rack 420 is attached at one end to stanchion rack 430 and is slidably received in the pinion housing 422. A pinion 424 driven by a lever 426 is rotatably retained in the pinion housing 422 and operably connected to the rack 420. The lever 426 is rotated to drive the pinion 424 along the rack 420 to spread apart the stanchion racks 430 and 432 and effectively a patient's ribs.

Torsional members 460 and 462 are attached to the top of the stanchion racks 430 and 432. Blade arms 474 and 476 extend outwardly from torsional members and attach to the blades 470 and 472. The torsional members comprise inner hubs 461 and 465 rotatably received in and operably connected to outer hubs 463 and 467. Locking levers 464 and 466 lock the inner hubs 461 and 465 in place relative to the outer hubs 463 and 467;"

page 48, lines 1-11: "Turning to Figure 28, an eleventh embodiment of the access platform 651 comprises a spreader housing 602 that includes a drive mechanism therein (not shown) and a drive slot 608 formed therein. A spreader lever 604 is mounted on top of the spreader housing 602 and is operably connected to the drive mechanism housed therein. An inferior blade 650 is interconnected to the drive mechanism via a blade arm 640 which extends outwardly to the inferior blade 650 from the spreader housing 602 in a direction generally normal to the housing 602. A tissue retractor 670 is attached to the blade 650 to assist in tissue retraction;"

page 50, line 17-page 51, line 9: "Referring to Figure 29, a twelfth embodiment of an access platform 659 is shown to comprise a modification of the eleventh embodiment of the access platform 651 shown in Figure 28. The offset assembly 690 of the access platform includes an offset housing 691 extending upwardly from the spreader housing 602 and adapted to slidably receive a curved rack 692. The blade arm 642 is attached to the curved rack 692 through a slot 699 in the housing 691. A worm gear 693 is positioned within the housing 691 and is operably connected to the curved rack 692. A worm gear shaft 689 extends from the worm gear 693 and connects to a lever 694 outside of the housing 691. Thus, to lift the superior blade 652 and ribs, the lever 694 is rotated in an appropriate direction to rotate the worm gear 693 to drive the curved rack 692 upwardly and outwardly from the housing 691. To lower the superior blade 652 from the offset position, the lever 694 is reverse rotated to drive the curved rack 692 in an opposite direction;"

page 51, line 10-page 52, line 20: " Turning to Figure 30, a thirteenth embodiment of the access platform 655 of the present invention comprises a generally elongated drive base 601 having a blade arm 640 and a pad arm 683 extending therefrom. The blade arm 640 extends in a generally normal direction from the drive base 601, while the pad arm 683, which is generally arcuately shaped, extends longitudinally and downwardly from the drive base 601. The pad arm 683 terminates in a sternal pad 681. A threaded shaft carrier 607 extends upwardly from the drive base 601 adjacent the blade arm 640. An inferior blade 650 having a tissue retractor 670 extending therefrom attaches to the blade arm 640. In a preferred construction, the inferior blade 650, tissue retractor 670, blade arm 640, threaded shaft carrier 607, drive base 601, pad arm 683, and sternal pad 681 are formed from one-piece construction.

A hollow threaded shaft 603 is threaded through the shaft carrier 607 and extends along the drive base 601 to rotatably attach to a hollow drive block 609. A spreader handle 605 is attached to the shaft 603 at an end opposite the drive block 609. A worm gear 697 positioned in the drive block 609, is fixed to the end of a shaft 696 that passes through the hollow threaded shaft 603 and attaches to an offset handle 695 beyond the spreader handle 605. The worm gear 697 is operably connected to an arcuate worm gear rack 698 that is positioned within the drive block 609 and connected to a branch 643 of a blade arm 642. The branch 643 of the blade arm 642 extends from the blade arm 642 in a normal direction and is pivotally mounted to the hollow drive block 609. The blade arm 642 extends downwardly from the branch 643 and attaches to a superior blade 652 with a tissue retractor 672 extending therefrom. A follower 619 extends downwardly from the base of the hollow drive block 609 and is received in a elongated drive slot 611 in the drive base 601. As the drive block 609 is transversely driven along the base 601 by the threaded shaft 603, the follower 609 slidably follows the drive slot 611 in the drive base 601;"

page 54, line 16-page 55, line 19: "Referring to Figures 31 and 32, a fourteenth embodiment of the access platform 610 of the present invention comprises a spreader component 612 that includes a rack 613, a spreader base 614 attached to one end of the rack 613 and a pinion housing 620 slidably received over the rack 613. A pinion 621 that is driven by a lever 622 is rotatably retained in the pinion housing 620 and operably connected to the rack 613.

A fixed pivot 616 having a socket 618 formed therein, extends from the spreader base 614. A fixed pivot lock 615 with a lock screw 617 is fixedly connected to the fixed pivot 616. A moveable pivot 624 having a socket 625 formed therein, extends from the housing 620. Rotatably and releasably received in and extending from the sockets 618 and 625 are stem portions 644 and 646 of a pair of blade arms 640 and 642, respectively. The stem 644 that is received in the socket 618 of the fixed pivot 616 includes a stop 645 formed on its exterior to abut the fixed pivot lock 615 and stop the travel of the stem 644. Branch portions 641 and 643 of the blade arms 640 and 642 extend downwardly from the stem portions 644 and 646 and attach to inferior and superior blades 650 and 652, respectively. The superior blade 652 which is advantageously located below and interconnected to the moveable pivot 624, comprises a recessed throat 654 to capture a rib adjacent to an incision in the patient's chest cavity and a pair of elongated vanes 656 and 657 used to offset a plurality of the patient's ribs. The inferior blade 650 which is interconnected to the fixed pivot 616 comprises a recessed throat 653 used to capture a rib adjacent to an incision in the patient's chest cavity;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 64, line 5-page 67, line 5: " Referring to Figure 39, a sixteenth embodiment of an access platform 780 comprises a generally elongated drive base 781 having a blade arm 782 extended generally in a normal direction from the drive base 781. A generally arcuate pad arm 786 extends generally longitudinally and downwardly from the drive base 781 and terminates at a sternal pad 785. A bearing support 791 extends upwardly from the drive base 781 adjacent the blade arm 782. An inferior blade 783 having a tissue retractor 784 extending therefrom attaches to the end of the inferior blade arm 782. In a preferred construction, the inferior blade 781, tissue retractor 784, blade arm 782, bearing support 791, drive base 781, pad arm 786 and sternal pad 785 are formed from one-piece construction.

A bearing 792 is mounted to the bearing support 791 and has a spreader handle 793 operably coupled thereto. A drive screw 787 having an offset handle 794 with a lever 795 attached to its first end, is threaded through the spreader handle 793 and freely passes through the bearing 792 and bearing support 791. The drive screw 787 extends longitudinally along the drive base 781 and is threaded through a carrier mount 789. The spreader handle 793 and the carrier mount 789 include oppositely wound threads. Rotation of the spreader handle 793 transversely drives the drive screw 787 and the carrier mount 789 mounted thereon along the drive base 781 and, thus, spreads or closes the blades 783 and 796. The carrier mount 789 includes a follower extending downwardly from its base that inserts into a drive slot 788 in the base 781. As the carrier mount 789 is translated across the drive base 781, the follower slides along the drive slot 788.

Extending upwardly and longitudinally outwardly in a direction away from the spreader handle 793, a carrier arm 790 extends from the carrier 789. At an end opposite the carrier mount 789, the carrier arm 790 pivotally captures at a pivot 799 a branch 797A of a blade arm 797. A tab 779 is fixed to the branch 797A adjacent the pivot 799 and extends downwardly in a direction normal to the branch 797A. The tab 779 contacts a shaft-end 787A of the drive shaft 787 opposite the offset handle 794 and extending beyond the carrier 789. The branch 797A extends outwardly from the pivot 799 in a normal direction to the carrier arm 790 and couples to the blade arm 797 at an end opposite the carrier arm 790. The blade arm 797 is generally arcuately shaped and extends downwardly from the branch 797A to connect to a superior blade 796 with a tissue retractor 798 extending therefrom. Because the pivot 799 is located above the superior blade 796, a lifting force is exerted on the superior blade 796 and ribs as a spreading force from the inferior blade 783 is transmitted to the superior blade 796 through the pivot 799.

Rotation of the offset handle 794, while holding the spreader handle 793 stationary, will thread the drive screw 787 through both the spreader handle 793 and the carrier 789, and thereby cause the drive screw 787 and carrier 789 to traverse the drive base 781 as well as causing the carrier 789 to traverse the drive screw 787 in the same direction. As a result, the carrier 789 traverses the drive base 781 at approximately two-times the speed that the carrier 789 traverses the drive screw 787 and thus, the length of the shaft-end 787A extending beyond the carrier 789 will increase or decrease at approximately one-half the speed at which the carrier 789 traverses the drive base 781. Therefore, as the offset handle 794 is rotated in a direction to spread the ribs, the ribs will be raised at a rate slower than they are spread as the superior blade 796 naturally rotates about the pivot 799 as the length of the shaft-end 787A extending beyond the carrier 789 decreases. Similarly, as the offset handle 794 is rotated in a direction to lower the offset ribs, the length of the shaft-end 787A will increase, at a rate slower than the rate at which the carrier 789 traverses the drive base 781. As the length of the shaft end 787A increases, it forces the tab 779, and thus the superior blade 797, to rotate in the counterclockwise direction around the pivot 799, and thereby further lowers the ribs. Because the carrier 789 traverses the drive base 781 at a faster rate than the shaft-end 787A increases, the distance between the blades 783 and 796 along the drive base 781 tends to decrease as the ribs are lowered;"

page 70, line 3-page 71, line 10: "Turning to Figure 40, a seventeenth embodiment of the access platform 800 comprises a spreader housing 801 which includes a drive mechanism housed therein (not shown) and a drive slot 803 cut into the spreader housing 801. A spreader lever 802 is mounted on the top of the spreader housing 801 and is operably connected to the drive mechanism housed therein. An inferior blade 805 having a tissue retractor 804 extending therefrom, is interconnected to the drive mechanism via a blade arm 806. The blade arm 806 extends outwardly from the spreader housing 801 in a generally normal direction.

A pad arm 817 connects at one end, or is formed integrally therewith, to the spreader housing 801 and extends outwardly therefrom. A sternal pad 816 is integrally formed on the pad arm 817 at an end opposite the housing 801. The pad arm 817 is generally arcuate to conform to an extended rib cage due to the offset of the ribs.

A superior blade 820 having a tissue retractor 821 extending therefrom, is connected to the bottom end of a generally arcuately shaped blade arm 818. The top end of the blade arm 818 is pivotally mounted on an offset stanchion 815 that extends upwardly from the pad arm 817. A compression member 813 is pivotally connected to the top of the stanchion 815 at pivot 814 and extends inwardly from the stanchion 815 toward the lever 802 on the spreader housing 801. An offset screw 811 having a handle 812 attached to its top end, is threaded through the compression member 813 at an end opposite the pivot 814 and is rotatably captured by a bushing assembly 808 rotatably coupled to a mount 807 that extends upwardly from the spreader housing 801. A counter-lift tab 809 extends inwardly from the blade arm 818 adjacent the stanchion 815. The lift tab 809 is operably connected to the compression member 813 through an offset spring 810 mounted therebetween;"

<p>an adjustable lifter blade mounted on said movable retractor arm;</p>	<p>See, e.g., page 19, lines 4-7: " Preferably, the access platform 10 comprises a pair of blades 50 and 51, a pair of support pads 80 and 81, a pair of tissue retractors 70 and 71, a pair of torsional members 30 and 31, and a spreader member 12;"</p>
	<p>page 21, lines 6-12: " Referring to Figure 2, the blades 50 and 51 preferably include elongated vanes 52 and 53, which slide beneath a plurality of the patient's ribs, and recessed arcuate throats 54 and 55 that receive the patient's ribs that are adjacent to the chest incision. The benefits of the recessed throats 54 and 55 and the elongated vanes 52 and 53 will be discussed below with regard to the operation of the access platform 10;"</p>
	<p>page 33, lines 6-14: " The blade arms 146 and 147 further comprise pivot sections 150 and 151 extending horizontally from the stems 152 and 153. Branches 148 and 149 extend downwardly and outwardly from the pivot sections 150 and 151 of the blade arms 146 and 147 to position the remainder of the access platform 110 away from the surgeon's working area. Branches 148 and 149 attach to blades 140 and 141. The blades 140 and 141 comprise elongated vane sections 142 and 143 extending outwardly from recessed throat sections 144 and 145;"</p>
	<p>page 39, lines 3-5: " A pair of blade arms 338 and 340 include branch sections 346 and 348 that extend downwardly from central portions 339 and 341 and connect to blades 350 and 352;"</p>
	<p>page 42, lines 3-19: "A sixth embodiment of the access platform 310 is shown in Figure 22 to comprise a combination of components from the first and fourth embodiments (Figures 2 and 18). More particularly, the torsional members 30 and 31 of the first embodiment are interposed between and operably connected to the fingers 330A and 330B and the housing 322, and interposed between and operably connected to the fingers 332A and 332B and the spreader base 328, respectively. In addition, the support pads 80 and 81 of the first embodiment are adjustably attached to the fingers 330A and 330B, 332A and 332B. By including the torsional members 30 and 31 and the support pads 80 and 81, second and third axes of rotation A_2 and A_3 are provided. Thus, as in the first embodiment, the torsional members 30 and 31 enable the access platform 310 to vertically displace the blades 350 and 352 and the retracted ribs. To vertically displace the blades 350 and 352, the blade arms 338 and 340 are fixedly coupled to the fingers 330A and 330B, 332A and 332B by pins 334 and 336.;"</p>

page 42, lines 20-page 43, line 21: "Turning to Figure 23, a seventh embodiment of the access platform is shown to comprise a modification of the fifth embodiment of the access platform shown in Figure 19. The access platform 310 in Figure 23 includes an offset assembly 308 interconnected to the blades 350 and 352. The offset assembly 308 comprises lead screws 313 and 314 extending between the blades 350 and 352 and further operably interconnecting the blades 350 and 352. At a first end, the lead screws 313 and 314 are rotatably captured by capture mounts 317 and 318. The capture mounts 317 and 318 are fixed to the blade 350. The threaded portion of the lead screws 313 and 314 threadably passes through a pair of lift mounts 315 and 316. The lift mount 315 is affixed to the blade arm 340 which is interconnected to the superior blade 352. The lift mount 316 is affixed to the top of a lift mount arm 319 extending vertically from the superior blade 352 to a height which is level with the lift mount 315 on the blade arm 340. Levers 309 and 311, which are attached to a second end of the lead screws 313 and 314, are used to rotate the lead screws 313 and 314 to drive the lift mounts 315 and 316 thereon. With the horizontal distance between the inferior and superior blades 350 and 352 adjustably fixed by the spreader member 312, the offset assembly 308 is only able to vertically displace the blade 352 relative to the blade 350. Thus, depending on the direction of rotation of the lead screws 313 and 314, the superior blade 352 will be raised or lowered to offset it relative to the inferior blade 350;"

page 45, line 3-page 46, line 5: "Turning to Figure 26, a ninth embodiment of the access platform 410 of the present invention is shown. The access platform 410 mounts to the table or rail via slides 438 and 440 that are locked in place by positioners 450 and 452. The slides 438 and 440 rotatably retain pinions 442 and 444 driven by levers 446 and 448 and slidably receive stanchion racks 430 and 432. The stanchion racks 430 and 432 include rack gears 434 and 436 that operably couple with pinions 442 and 444. The levers 446 and 448 are rotated to drive the pinions 442 and 444 along rack gears 434 and 436 to adjust the height of the stanchion racks 430 and 432 relative to the table or patient, or to vertically offset blades 470 and 472 relative to one another.

A pinion housing 422 is slidably attached to the stanchion rack 432 towards its upper end. A rack 420 is attached at one end to stanchion rack 430 and is slidably received in the pinion housing 422. A pinion 424 driven by a lever 426 is rotatably retained in the pinion housing 422 and operably connected to the rack 420. The lever 426 is rotated to drive the pinion 424 along the rack 420 to spread apart the stanchion racks 430 and 432 and effectively a patient's ribs.

Torsional members 460 and 462 are attached to the top of the stanchion racks 430 and 432. Blade arms 474 and 476 extend outwardly from torsional members and attach to the blades 470 and 472. The torsional members comprise inner hubs 461 and 465 rotatably received in and operably connected to outer hubs 463 and 467. Locking levers 464 and 466 lock the inner hubs 461 and 465 in place relative to the outer hubs 463 and 467;"

page 48, lines 1-11: "Turning to Figure 28, an eleventh embodiment of the access platform 651 comprises a spreader housing 602 that includes a drive mechanism therein (not shown) and a drive slot 608 formed therein. A spreader lever 604 is mounted on top of the spreader housing 602 and is operably connected to the drive mechanism housed therein. An inferior blade 650 is interconnected to the drive mechanism via a blade arm 640 which extends outwardly to the inferior blade 650 from the spreader housing 602 in a direction generally normal to the housing 602. A tissue retractor 670 is attached to the blade 650 to assist in tissue retraction;"

page 50, line 17-page 51, line 9: "Referring to Figure 29, a twelfth embodiment of an access platform 659 is shown to comprise a modification of the eleventh embodiment of the access platform 651 shown in Figure 28. The offset assembly 690 of the access platform includes an offset housing 691 extending upwardly from the spreader housing 602 and adapted to slidably receive a curved rack 692. The blade arm 642 is attached to the curved rack 692 through a slot 699 in the housing 691. A worm gear 693 is positioned within the housing 691 and is operably connected to the curved rack 692. A worm gear shaft 689 extends from the worm gear 693 and connects to a lever 694 outside of the housing 691. Thus, to lift the superior blade 652 and ribs, the lever 694 is rotated in an appropriate direction to rotate the worm gear 693 to drive the curved rack 692 upwardly and outwardly from the housing 691. To lower the superior blade 652 from the offset position, the lever 694 is reverse rotated to drive the curved rack 692 in an opposite direction;"

page 51, line 10-page 52, line 20: " Turning to Figure 30, a thirteenth embodiment of the access platform 655 of the present invention comprises a generally elongated drive base 601 having a blade arm 640 and a pad arm 683 extending therefrom. The blade arm 640 extends in a generally normal direction from the drive base 601, while the pad arm 683, which is generally arcuately shaped, extends longitudinally and downwardly from the drive base 601. The pad arm 683 terminates in a sternal pad 681. A threaded shaft carrier 607 extends upwardly from the drive base 601 adjacent the blade arm 640. An inferior blade 650 having a tissue retractor 670 extending therefrom attaches to the blade arm 640. In a preferred construction, the inferior blade 650, tissue retractor 670, blade arm 640, threaded shaft carrier 607, drive base 601, pad arm 683, and sternal pad 681 are formed from one-piece construction.

A hollow threaded shaft 603 is threaded through the shaft carrier 607 and extends along the drive base 601 to rotatably attach to a hollow drive block 609. A spreader handle 605 is attached to the shaft 603 at an end opposite the drive block 609. A worm gear 697 positioned in the drive block 609, is fixed to the end of a shaft 696 that passes through the hollow threaded shaft 603 and attaches to an offset handle 695 beyond the spreader handle 605. The worm gear 697 is operably connected to an arcuate worm gear rack 698 that is positioned within the drive block 609 and connected to a branch 643 of a blade arm 642. The branch 643 of the blade arm 642 extends from the blade arm 642 in a normal direction and is pivotally mounted to the hollow drive block 609. The blade arm 642 extends downwardly from the branch 643 and attaches to a superior blade 652 with a tissue retractor 672 extending therefrom. A follower 619 extends downwardly from the base of the hollow drive block 609 and is received in a elongated drive slot 611 in the drive base 601. As the drive block 609 is transversely driven along the base 601 by the threaded shaft 603, the follower 609 slidably follows the drive slot 611 in the drive base 601;"

page 54, line 16-page 55, line 19: "Referring to Figures 31 and 32, a fourteenth embodiment of the access platform 610 of the present invention comprises a spreader component 612 that includes a rack 613, a spreader base 614 attached to one end of the rack 613 and a pinion housing 620 slidably received over the rack 613. A pinion 621 that is driven by a lever 622 is rotatably retained in the pinion housing 620 and operably connected to the rack 613.

A fixed pivot 616 having a socket 618 formed therein, extends from the spreader base 614. A fixed pivot lock 615 with a lock screw 617 is fixedly connected to the fixed pivot 616. A moveable pivot 624 having a socket 625 formed therein, extends from the housing 620. Rotatably and releasably received in and extending from the sockets 618 and 625 are stem portions 644 and 646 of a pair of blade arms 640 and 642, respectively. The stem 644 that is received in the socket 618 of the fixed pivot 616 includes a stop 645 formed on its exterior to abut the fixed pivot lock 615 and stop the travel of the stem 644. Branch portions 641 and 643 of the blade arms 640 and 642 extend downwardly from the stem portions 644 and 646 and attach to inferior and superior blades 650 and 652, respectively. The superior blade 652 which is advantageously located below and interconnected to the moveable pivot 624, comprises a recessed throat 654 to capture a rib adjacent to an incision in the patient's chest cavity and a pair of elongated vanes 656 and 657 used to offset a plurality of the patient's ribs. The inferior blade 650 which is interconnected to the fixed pivot 616 comprises a recessed throat 653 used to capture a rib adjacent to an incision in the patient's chest cavity;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 64, line 5-page 67, line 5: " Referring to Figure 39, a sixteenth embodiment of an access platform 780 comprises a generally elongated drive base 781 having a blade arm 782 extended generally in a normal direction from the drive base 781. A generally arcuate pad arm 786 extends generally longitudinally and downwardly from the drive base 781 and terminates at a sternal pad 785. A bearing support 791 extends upwardly from the drive base 781 adjacent the blade arm 782. An inferior blade 783 having a tissue retractor 784 extending therefrom attaches to the end of the inferior blade arm 782. In a preferred construction, the inferior blade 781, tissue retractor 784, blade arm 782, bearing support 791, drive base 781, pad arm 786 and sternal pad 785 are formed from one-piece construction.

A bearing 792 is mounted to the bearing support 791 and has a spreader handle 793 operably coupled thereto. A drive screw 787 having an offset handle 794 with a lever 795 attached to its first end, is threaded through the spreader handle 793 and freely passes through the bearing 792 and bearing support 791. The drive screw 787 extends longitudinally along the drive base 781 and is threaded through a carrier mount 789. The spreader handle 793 and the carrier mount 789 include oppositely wound threads. Rotation of the spreader handle 793 transversely drives the drive screw 787 and the carrier mount 789 mounted thereon along the drive base 781 and, thus, spreads or closes the blades 783 and 796. The carrier mount 789 includes a follower extending downwardly from its base that inserts into a drive slot 788 in the base 781. As the carrier mount 789 is translated across the drive base 781, the follower slides along the drive slot 788.

Extending upwardly and longitudinally outwardly in a direction away from the spreader handle 793, a carrier arm 790 extends from the carrier 789. At an end opposite the carrier mount 789, the carrier arm 790 pivotally captures at a pivot 799 a branch 797A of a blade arm 797. A tab 779 is fixed to the branch 797A adjacent the pivot 799 and extends downwardly in a direction normal to the branch 797A. The tab 779 contacts a shaft-end 787A of the drive shaft 787 opposite the offset handle 794 and extending beyond the carrier 789. The branch 797A extends outwardly from the pivot 799 in a normal direction to the carrier arm 790 and couples to the blade arm 797 at an end opposite the carrier arm 790. The blade arm 797 is generally arcuately shaped and extends downwardly from the branch 797A to connect to a superior blade 796 with a tissue retractor 798 extending therefrom. Because the pivot 799 is located above the superior blade 796, a lifting force is exerted on the superior blade 796 and ribs as a spreading force from the inferior blade 783 is transmitted to the superior blade 796 through the pivot 799.

Rotation of the offset handle 794, while holding the spreader handle 793 stationary, will thread the drive screw 787 through both the spreader handle 793 and the carrier 789, and thereby cause the drive screw 787 and carrier 789 to traverse the drive base 781 as well as causing the carrier 789 to traverse the drive screw 787 in the same direction. As a result, the carrier 789 traverses the drive base 781 at approximately two-times the speed that the carrier 789 traverses the drive screw 787 and thus, the length of the shaft-end 787A extending beyond the carrier 789 will increase or decrease at approximately one-half the speed at which the carrier 789 traverses the drive base 781. Therefore, as the offset handle 794 is rotated in a direction to spread the ribs, the ribs will be raised at a rate slower than they are spread as the superior blade 796 naturally rotates about the pivot 799 as the length of the shaft-end 787A extending beyond the carrier 789 decreases. Similarly, as the offset handle 794 is rotated in a direction to lower the offset ribs, the length of the shaft-end 787A will increase, at a rate slower than the rate at which the carrier 789 traverses the drive base 781. As the length of the shaft end 787A increases, it forces the tab 779, and thus the superior blade 797, to rotate in the counterclockwise direction around the pivot 799, and thereby further lowers the ribs. Because the carrier 789 traverses the drive base 781 at a faster rate than the shaft-end 787A increases, the distance between the blades 783 and 796 along the drive base 781 tends to decrease as the ribs are lowered;"

page 70, line 3-page 71, line 10: "Turning to Figure 40, a seventeenth embodiment of the access platform 800 comprises a spreader housing 801 which includes a drive mechanism housed therein (not shown) and a drive slot 803 cut into the spreader housing 801. A spreader lever 802 is mounted on the top of the spreader housing 801 and is operably connected to the drive mechanism housed therein. An inferior blade 805 having a tissue retractor 804 extending therefrom, is interconnected to the drive mechanism via a blade arm 806. The blade arm 806 extends outwardly from the spreader housing 801 in a generally normal direction.

A pad arm 817 connects at one end, or is formed integrally therewith, to the spreader housing 801 and extends outwardly therefrom. A sternal pad 816 is integrally formed on the pad arm 817 at an end opposite the housing 801. The pad arm 817 is generally arcuate to conform to an extended rib cage due to the offset of the ribs.

A superior blade 820 having a tissue retractor 821 extending therefrom, is connected to the bottom end of a generally arcuately shaped blade arm 818. The top end of the blade arm 818 is pivotally mounted on an offset stanchion 815 that extends upwardly from the pad arm 817. A compression member 813 is pivotally connected to the top of the stanchion 815 at pivot 814 and extends inwardly from the stanchion 815 toward the lever 802 on the spreader housing 801. An offset screw 811 having a handle 812 attached to its top end, is threaded through the compression member 813 at an end opposite the pivot 814 and is rotatably captured by a bushing assembly 808 rotatably coupled to a mount 807 that extends upwardly from the spreader housing 801. A counter-lift tab 809 extends inwardly from the blade arm 818 adjacent the stanchion 815. The lift tab 809 is operably connected to the compression member 813 through an offset spring 810 mounted therebetween;"

<p>tilting means for tilting said retractor to lift a portion of a ribcage to provide improved access to the intermammary artery.</p>	<p>See, e.g., page 19, lines 4-23: "Preferably, the access platform 10 comprises a pair of blades 50 and 51, a pair of support pads 80 and 81, a pair of tissue retractors 70 and 71, a pair of torsional members 30 and 31, and a spreader member 12. The torsional members 30 and 31 and the spreader member 12 preferably extend away from the blades 50 and 51 and the tissue retractors 70 and 71 and, thus, the chest incision, in a plane relatively parallel to the patient's chest. As a result, the access platform 10 advantageously maintains a low profile that remains substantially clear of the surgeon's working space.</p> <p>Referring to Figure 2, the components of the access platform 10 are shown less the tissue retractors 70 and 71. The spreader member 12 preferably comprises a rotatable hub 14 including operably coupled upper and lower hub halves 17 and 16. A pair of spreader arms 19 and 18 extend from the upper and lower hub halves 17 and 16, respectively, and connect to the torsional members 31 and 30, respectively. Preferably, the hub 14 includes a harmonic gear drive 20 used to rotate the upper hub half 17 relative to the lower hub half 16 and, thus, spread or close the spreader arms 18 and 19 to retract or relax the patient's ribs;"</p> <p>page 23, lines 1-18: " The torsional members 30 and 31 are operably connected to the torque bases 32 and 33 and the spreader arms 18 and 19 to enable the access platform 10 to both laterally retract and vertically displace a patient's ribs. Thus, the torsional members 30 and 31 enable the access platform 10 to be advantageously self-contained such that the force necessary to spread and vertically displace a patient's ribs, and the force necessary to depress the patient's sternum, is applied by the access platform 10 itself rather than through additional external devices.</p> <p>The torsional members 30 and 31 preferably comprise a reduction gear assembly 40 (see Figure 4). The reduction gear assembly 40, as shown for torsional member 31, comprises a drive nut 42 rotatably captured on the end of the shaft of the spreader arm 19, a first shaft 45 axially extending from the spreader arm 19, and a second shaft 47 extending from the torque base 33. The second shaft 47 is rotatably captured over the first shaft 45 by a shoulder screw 49;"</p> <p>page 32, line 21-page 33, line 5: " Vertical displacement members 130 and 131 preferably comprise curved racks 132 and 133 slidably received within pinion housings 134 and 135. The pinion housings 134 and 135 are fixedly attached to the pinion housings 122 and 121. The pinion housings 134 and 135 rotatably retain pinions 136 and 137 driven by levers 138 and 139. Sockets 154 and 155 are formed in the lower ends of the curved racks 132 and 133. Stems 152 and 153 of blade arms 146 and 147 are releasably received by and horizontally extend from the sockets 154 and 155;"</p> <p>page 37, lines 12-19: " A vertical displacement member 250 comprises a support pad 252 that pivotally connects to the pinion housing 216 at a pivot 254 and extends laterally away from the pinion housing 216. An "L"-shaped lever 256 is pivotally connected to the rack 214 at a pivot 258 at the end of the short leg of the "L"-shaped lever 256. A slide 259 is formed at the intersection of the short and long legs of the "L"-shaped lever 256. The slide 259 slidably contacts the support pad 252;"</p> <p>page 38, lines 4-11: "The "L"-shaped lever 256 is then rotated downwardly in a counterclockwise direction toward the patient's chest such that the slide portion 259 slides along the support pad 252 toward the housing 220 while the "L"-shaped lever 256 rotates about the pivot 258. As a result, one end of the rack 214 is raised to vertically offset blade 230 and ribs R relative to the blade 231 and ribs R;"</p>
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page 41, lines 1-10: " Turning to Figures 20 and 21, a pry bar 370, which is used in conjunction with the access platform 310 shown in Figure 18 or 19 to offset a patient's ribs, comprises a generally "S"-shaped body 372 pivotally connected to a pivot base 377 at pivot 378. The pivot base 377 is in turn pivotally connected to a blade arm 382 at pivot 380. The blade arm 382 extends downwardly from the pivot 380 and connects to a blade 384. The blade 384 includes an elongated vane 386 and a deep recessed throat 388. A sternal pad 374 is connected to a post 379 that is slidably mounted on the lower portion 373 of the "S"-shaped body 372 via a slide 376;"

page 42, lines 3-19: "A sixth embodiment of the access platform 310 is shown in Figure 22 to comprise a combination of components from the first and fourth embodiments (Figures 2 and 18). More particularly, the torsional members 30 and 31 of the first embodiment are interposed between and operably connected to the fingers 330A and 330B and the housing 322, and interposed between and operably connected to the fingers 332A and 332B and the spreader base 328, respectively. In addition, the support pads 80 and 81 of the first embodiment are adjustably attached to the fingers 330A and 330B, 332A and 332B. By including the torsional members 30 and 31 and the support pads 80 and 81, second and third axes of rotation A_2 and A_3 are provided. Thus, as in the first embodiment, the torsional members 30 and 31 enable the access platform 310 to vertically displace the blades 350 and 352 and the retracted ribs. To vertically displace the blades 350 and 352, the blade arms 338 and 340 are fixedly coupled to the fingers 330A and 330B, 332A and 332B by pins 334 and 336.;"

page 42, line 20 - page 43, line 21: "Turning to Figure 23, a seventh embodiment of the access platform is shown to comprise a modification of the fifth embodiment of the access platform shown in Figure 19. The access platform 310 in Figure 23 includes an offset assembly 308 interconnected to the blades 350 and 352. The offset assembly 308 comprises lead screws 313 and 314 extending between the blades 350 and 352 and further operably interconnecting the blades 350 and 352. At a first end, the lead screws 313 and 314 are rotatably captured by capture mounts 317 and 318. The capture mounts 317 and 318 are fixed to the blade 350. The threaded portion of the lead screws 313 and 314 threadably passes through a pair of lift mounts 315 and 316. The lift mount 315 is affixed to the blade arm 340 which is interconnected to the superior blade 352. The lift mount 316 is affixed to the top of a lift mount arm 319 extending vertically from the superior blade 352 to a height which is level with the lift mount 315 on the blade arm 340. Levers 309 and 311, which are attached to a second end of the lead screws 313 and 314, are used to rotate the lead screws 313 and 314 to drive the lift mounts 315 and 316 thereon. With the horizontal distance between the inferior and superior blades 350 and 352 adjustably fixed by the spreader member 312, the offset assembly 308 is only able to vertically displace the blade 352 relative to the blade 350. Thus, depending on the direction of rotation of the lead screws 313 and 314, the superior blade 352 will be raised or lowered to offset it relative to the inferior blade 350;"

page 45, line 23-page 46, line 21: " Torsional members 460 and 462 are attached to the top of the stanchion racks 430 and 432. Blade arms 474 and 476 extend outwardly from torsional members and attach to the blades 470 and 472. The torsional members comprise inner hubs 461 and 465 rotatably received in and operably connected to outer hubs 463 and 467. Locking levers 464 and 466 lock the inner hubs 461 and 465 in place relative to the outer hubs 463 and 467.

In operation, the access platform 410 is positioned such that the blades 470 and 472 can be inserted into an incision in a patient's chest and then attached to the blade arms 474 and 476. Once the blades 470 and 472 are positioned in the incision and attached to the blade arms 474 and 476, the lever 426 is rotated to spread the blades 470 and 472 and the patient's ribs apart. The blades 470 and 472 can be effectively offset by rotating the inner hubs 461 and 465 relative to the outer hubs 463 and 467. While the blades 470 and 472 are rotated, the stanchion racks 430 and 432 can be raised or lowered by rotating levers 486 and 488 to drive pinions 442 and 444. By raising or lowering the stanchion racks 430 and 432, the blades 470 and 472 can be effectively raised or lowered relative to one another to further offset the blades 470 and 472 relative to one another. A wrench 468 is utilized to rotate the inner hubs 461 and 465 relative to the outer hubs 463 and 467;"

page 48, line 16-page 49, line 5: " A superior blade 652 having a tissue retractor 672 extending therefrom is connected to the bottom end of a blade arm 642. The top end of the blade arm 642 is pivotally connected to an offset drive assembly 660. The offset drive assembly 660 comprises a guide link 666 and a drive link 665 which are pivotally connected at pivots 687 and 688 to a mount 685 extending upwardly from the pad arm 683 and at pivots 668 and 667 to the blade arm 642. The drive link 665 is also pivotally connected to a drive carrier 662 which threadably captures a lead screw 661 and is transversely driven along the lead screw 661 as the lead screw 661 is rotated. A lever 664 is attached to the top of the lead screw 661 to rotate the lead screw 661. The base of the lead screw 661 is rotatably captured in a bushing 663 which is rotatably captured in a drive mount 606 extending up from the spreader housing 602;"

page 50, line 17-page 51, line 9: "Referring to Figure 29, a twelfth embodiment of an access platform 659 is shown to comprise a modification of the eleventh embodiment of the access platform 651 shown in Figure 28. The offset assembly 690 of the access platform includes an offset housing 691 extending upwardly from the spreader housing 602 and adapted to slidably receive a curved rack 692. The blade arm 642 is attached to the curved rack 692 through a slot 699 in the housing 691. A worm gear 693 is positioned within the housing 691 and is operably connected to the curved rack 692. A worm gear shaft 689 extends from the worm gear 693 and connects to a lever 694 outside of the housing 691. Thus, to lift the superior blade 652 and ribs, the lever 694 is rotated in an appropriate direction to rotate the worm gear 693 to drive the curved rack 692 upwardly and outwardly from the housing 691. To lower the superior blade 652 from the offset position, the lever 694 is reverse rotated to drive the curved rack 692 in an opposite direction;"

page 51, line 10-page 52, line 20: " Turning to Figure 30, a thirteenth embodiment of the access platform 655 of the present invention comprises a generally elongated drive base 601 having a blade arm 640 and a pad arm 683 extending therefrom. The blade arm 640 extends in a generally normal direction from the drive base 601, while the pad arm 683, which is generally arcuately shaped, extends longitudinally and downwardly from the drive base 601. The pad arm 683 terminates in a sternal pad 681. A threaded shaft carrier 607 extends upwardly from the drive base 601 adjacent the blade arm 640. An inferior blade 650 having a tissue retractor 670 extending therefrom attaches to the blade arm 640. In a preferred construction, the inferior blade 650, tissue retractor 670, blade arm 640, threaded shaft carrier 607, drive base 601, pad arm 683, and sternal pad 681 are formed from one-piece construction.

A hollow threaded shaft 603 is threaded through the shaft carrier 607 and extends along the drive base 601 to rotatably attach to a hollow drive block 609. A spreader handle 605 is attached to the shaft 603 at an end opposite the drive block 609. A worm gear 697 positioned in the drive block 609, is fixed to the end of a shaft 696 that passes through the hollow threaded shaft 603 and attaches to an offset handle 695 beyond the spreader handle 605. The worm gear 697 is operably connected to an arcuate worm gear rack 698 that is positioned within the drive block 609 and connected to a branch 643 of a blade arm 642. The branch 643 of the blade arm 642 extends from the blade arm 642 in a normal direction and is pivotally mounted to the hollow drive block 609. The blade arm 642 extends downwardly from the branch 643 and attaches to a superior blade 652 with a tissue retractor 672 extending therefrom. A follower 619 extends downwardly from the base of the hollow drive block 609 and is received in a elongated drive slot 611 in the drive base 601. As the drive block 609 is transversely driven along the base 601 by the threaded shaft 603, the follower 609 slidably follows the drive slot 611 in the drive base 601,"

page 56, line 3-page 57, line 22: " The branch portion 643 of the blade arm 642 that is interconnected to the moveable pivot 624 extends higher vertically than the branch portion 641 of the blade arm 640 that is interconnected to the fixed pivot 616 when the blades 650 and 652 are substantially level (see Figure 29). This construction tends to increase the moment about the moveable pivot 624 caused by the offset of the movable pivot from the center-of-effort of the spreading force at the blades 650 and 652. Because the movable pivot 624 is located above the superior blade 652, a lifting force is naturally exerted on the superior blade 652 and ribs as spreading occurs.

To add additional offset of the superior blade 652 once the blades 650 and 652 are separated and offset, a vertical displacement component 630 is included on the access platform 610. The vertical displacement component 630 comprises a rib compression shoe 680, a substantially "S" shaped shoe arm 682 connected to the shoe 680 at one end and pivotally connected to the stem 646 of the blade arm 642 at the other end, and an adjustable offset link 632 connected to the pinion housing 620 and operably connected to the shoe arm 682 and shoe 680,"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 64, line 5-page 67, line 5: " Referring to Figure 39, a sixteenth embodiment of an access platform 780 comprises a generally elongated drive base 781 having a blade arm 782 extended generally in a normal direction from the drive base 781. A generally arcuate pad arm 786 extends generally longitudinally and downwardly from the drive base 781 and terminates at a sternal pad 785. A bearing support 791 extends upwardly from the drive base 781 adjacent the blade arm 782. An inferior blade 783 having a tissue retractor 784 extending therefrom attaches to the end of the inferior blade arm 782. In a preferred construction, the inferior blade 781, tissue retractor 784, blade arm 782, bearing support 791, drive base 781, pad arm 786 and sternal pad 785 are formed from one-piece construction.

A bearing 792 is mounted to the bearing support 791 and has a spreader handle 793 operably coupled thereto. A drive screw 787 having an offset handle 794 with a lever 795 attached to its first end, is threaded through the spreader handle 793 and freely passes through the bearing 792 and bearing support 791. The drive screw 787 extends longitudinally along the drive base 781 and is threaded through a carrier mount 789. The spreader handle 793 and the carrier mount 789 include oppositely wound threads. Rotation of the spreader handle 793 transversely drives the drive screw 787 and the carrier mount 789 mounted thereon along the drive base 781 and, thus, spreads or closes the blades 783 and 796. The carrier mount 789 includes a follower extending downwardly from its base that inserts into a drive slot 788 in the base 781. As the carrier mount 789 is translated across the drive base 781, the follower slides along the drive slot 788.

Extending upwardly and longitudinally outwardly in a direction away from the spreader handle 793, a carrier arm 790 extends from the carrier 789. At an end opposite the carrier mount 789, the carrier arm 790 pivotally captures at a pivot 799 a branch 797A of a blade arm 797. A tab 779 is fixed to the branch 797A adjacent the pivot 799 and extends downwardly in a direction normal to the branch 797A. The tab 779 contacts a shaft-end 787A of the drive shaft 787 opposite the offset handle 794 and extending beyond the carrier 789. The branch 797A extends outwardly from the pivot 799 in a normal direction to the carrier arm 790 and couples to the blade arm 797 at an end opposite the carrier arm 790. The blade arm 797 is generally arcuately shaped and extends downwardly from the branch 797A to connect to a superior blade 796 with a tissue retractor 798 extending therefrom. Because the pivot 799 is located above the superior blade 796, a lifting force is exerted on the superior blade 796 and ribs as a spreading force from the inferior blade 783 is transmitted to the superior blade 796 through the pivot 799.

Rotation of the offset handle 794, while holding the spreader handle 793 stationary, will thread the drive screw 787 through both the spreader handle 793 and the carrier 789, and thereby cause the drive screw 787 and carrier 789 to traverse the drive base 781 as well as causing the carrier 789 to traverse the drive screw 787 in the same direction. As a result, the carrier 789 traverses the drive base 781 at approximately two-times the speed that the carrier 789 traverses the drive screw 787 and thus, the length of the shaft-end 787A extending beyond the carrier 789 will increase or decrease at approximately one-half the speed at which the carrier 789 traverses the drive base 781. Therefore, as the offset handle 794 is rotated in a direction to spread the ribs, the ribs will be raised at a rate slower than they are spread as the superior blade 796 naturally rotates about the pivot 799 as the length of the shaft-end 787A extending beyond the carrier 789 decreases. Similarly, as the offset handle 794 is rotated in a direction to lower the offset ribs, the length of the shaft-end 787A will increase, at a rate slower than the rate at which the carrier 789 traverses the drive base 781. As the length of the shaft end 787A increases, it forces the tab 779, and thus the superior blade 797, to rotate in the counterclockwise direction around the pivot 799, and thereby further lowers the ribs. Because the carrier 789 traverses the drive base 781 at a faster rate than the shaft-end 787A increases, the distance between the blades 783 and 796 along the drive base 781 tends to decrease as the ribs are lowered;"

page 70, line 3-page 71, line 10: "Turning to Figure 40, a seventeenth embodiment of the access platform 800 comprises a spreader housing 801 which includes a drive mechanism housed therein (not shown) and a drive slot 803 cut into the spreader housing 801. A spreader lever 802 is mounted on the top of the spreader housing 801 and is operably connected to the drive mechanism housed therein. An inferior blade 805 having a tissue retractor 804 extending therefrom, is interconnected to the drive mechanism via a blade arm 806. The blade arm 806 extends outwardly from the spreader housing 801 in a generally normal direction.

A pad arm 817 connects at one end, or is formed integrally therewith, to the spreader housing 801 and extends outwardly therefrom. A sternal pad 816 is integrally formed on the pad arm 817 at an end opposite the housing 801. The pad arm 817 is generally arcuate to conform to an extended rib cage due to the offset of the ribs.

A superior blade 820 having a tissue retractor 821 extending therefrom, is connected to the bottom end of a generally arcuately shaped blade arm 818. The top end of the blade arm 818 is pivotally mounted on an offset stanchion 815 that extends upwardly from the pad arm 817. A compression member 813 is pivotally connected to the top of the stanchion 815 at pivot 814 and extends inwardly from the stanchion 815 toward the lever 802 on the spreader housing 801. An offset screw 811 having a handle 812 attached to its top end, is threaded through the compression member 813 at an end opposite the pivot 814 and is rotatably captured by a bushing assembly 808 rotatably coupled to a mount 807 that extends upwardly from the spreader housing 801. A counter-lift tab 809 extends inwardly from the blade arm 818 adjacent the stanchion 815. The lift tab 809 is operably connected to the compression member 813 through an offset spring 810 mounted therebetween;"

<p>90. The retractor according to claim 89 in which said adjustable lifter blade comprises:</p> <p style="padding-left: 40px;">blade mounting means;</p> <p style="padding-left: 40px;">an adjustable lifter blade hingedly attached to said blade mounting means;</p>	<p>See, e.g., figures 31-32, 33-34, 39, 40</p> <p>page 48, lines 1-11: "Turning to Figure 28, an eleventh embodiment of the access platform 651 comprises a spreader housing 602 that includes a drive mechanism therein (not shown) and a drive slot 608 formed therein. A spreader lever 604 is mounted on top of the spreader housing 602 and is operably connected to the drive mechanism housed therein. An inferior blade 650 is interconnected to the drive mechanism via a blade arm 640 which extends outwardly to the inferior blade 650 from the spreader housing 602 in a direction generally normal to the housing 602. A tissue retractor 670 is attached to the blade 650 to assist in tissue retraction;"</p> <p>page 51, line 10-page 52, line 20: " Turning to Figure 30, a thirteenth embodiment of the access platform 655 of the present invention comprises a generally elongated drive base 601 having a blade arm 640 and a pad arm 683 extending therefrom. The blade arm 640 extends in a generally normal direction from the drive base 601, while the pad arm 683, which is generally arcuately shaped, extends longitudinally and downwardly from the drive base 601. The pad arm 683 terminates in a sternal pad 681. A threaded shaft carrier 607 extends upwardly from the drive base 601 adjacent the blade arm 640. An inferior blade 650 having a tissue retractor 670 extending therefrom attaches to the blade arm 640. In a preferred construction, the inferior blade 650, tissue retractor 670, blade arm 640, threaded shaft carrier 607, drive base 601, pad arm 683, and sternal pad 681 are formed from one-piece construction.</p> <p style="padding-left: 40px;">A hollow threaded shaft 603 is threaded through the shaft carrier 607 and extends along the drive base 601 to rotatably attach to a hollow drive block 609. A spreader handle 605 is attached to the shaft 603 at an end opposite the drive block 609. A worm gear 697 positioned in the drive block 609, is fixed to the end of a shaft 696 that passes through the hollow threaded shaft 603 and attaches to an offset handle 695 beyond the spreader handle 605. The worm gear 697 is operably connected to an arcuate worm gear rack 698 that is positioned within the drive block 609 and connected to a branch 643 of a blade arm 642. The branch 643 of the blade arm 642 extends from the blade arm 642 in a normal direction and is pivotally mounted to the hollow drive block 609. The blade arm 642 extends downwardly from the branch 643 and attaches to a superior blade 652 with a tissue retractor 672 extending therefrom. A follower 619 extends downwardly from the base of the hollow drive block 609 and is received in a elongated drive slot 611 in the drive base 601. As the drive block 609 is transversely driven along the base 601 by the threaded shaft 603, the follower 609 slidably follows the drive slot 611 in the drive base 601;"</p>
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page 54, line 16-page 55, line 19: "Referring to Figures 31 and 32, a fourteenth embodiment of the access platform 610 of the present invention comprises a spreader component 612 that includes a rack 613, a spreader base 614 attached to one end of the rack 613 and a pinion housing 620 slidably received over the rack 613. A pinion 621 that is driven by a lever 622 is rotatably retained in the pinion housing 620 and operably connected to the rack 613.

A fixed pivot 616 having a socket 618 formed therein, extends from the spreader base 614. A fixed pivot lock 615 with a lock screw 617 is fixedly connected to the fixed pivot 616. A moveable pivot 624 having a socket 625 formed therein, extends from the housing 620. Rotatably and releasably received in and extending from the sockets 618 and 625 are stem portions 644 and 646 of a pair of blade arms 640 and 642, respectively. The stem 644 that is received in the socket 618 of the fixed pivot 616 includes a stop 645 formed on its exterior to abut the fixed pivot lock 615 and stop the travel of the stem 644. Branch portions 641 and 643 of the blade arms 640 and 642 extend downwardly from the stem portions 644 and 646 and attach to inferior and superior blades 650 and 652, respectively. The superior blade 652 which is advantageously located below and interconnected to the moveable pivot 624, comprises a recessed throat 654 to capture a rib adjacent to an incision in the patient's chest cavity and a pair of elongated vanes 656 and 657 used to offset a plurality of the patient's ribs. The inferior blade 650 which is interconnected to the fixed pivot 616 comprises a recessed throat 653 used to capture a rib adjacent to an incision in the patient's chest cavity;"

page 56, lines 3-13: " The branch portion 643 of the blade arm 642 that is interconnected to the moveable pivot 624 extends higher vertically than the branch portion 641 of the blade arm 640 that is interconnected to the fixed pivot 616 when the blades 650 and 652 are substantially level (see Figure 29). This construction tends to increase the moment about the moveable pivot 624 caused by the offset of the movable pivot from the center-of-effort of the spreading force at the blades 650 and 652. Because the movable pivot 624 is located above the superior blade 652, a lifting force is naturally exerted on the superior blade 652 and ribs as spreading occurs;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 64, line 5-page 67, line 5: " Referring to Figure 39, a sixteenth embodiment of an access platform 780 comprises a generally elongated drive base 781 having a blade arm 782 extended generally in a normal direction from the drive base 781. A generally arcuate pad arm 786 extends generally longitudinally and downwardly from the drive base 781 and terminates at a sternal pad 785. A bearing support 791 extends upwardly from the drive base 781 adjacent the blade arm 782. An inferior blade 783 having a tissue retractor 784 extending therefrom attaches to the end of the inferior blade arm 782. In a preferred construction, the inferior blade 781, tissue retractor 784, blade arm 782, bearing support 791, drive base 781, pad arm 786 and sternal pad 785 are formed from one-piece construction.

A bearing 792 is mounted to the bearing support 791 and has a spreader handle 793 operably coupled thereto. A drive screw 787 having an offset handle 794 with a lever 795 attached to its first end, is threaded through the spreader handle 793 and freely passes through the bearing 792 and bearing support 791. The drive screw 787 extends longitudinally along the drive base 781 and is threaded through a carrier mount 789. The spreader handle 793 and the carrier mount 789 include oppositely wound threads. Rotation of the spreader handle 793 transversely drives the drive screw 787 and the carrier mount 789 mounted thereon along the drive base 781 and, thus, spreads or closes the blades 783 and 796. The carrier mount 789 includes a follower extending downwardly from its base that inserts into a drive slot 788 in the base 781. As the carrier mount 789 is translated across the drive base 781, the follower slides along the drive slot 788.

Extending upwardly and longitudinally outwardly in a direction away from the spreader handle 793, a carrier arm 790 extends from the carrier 789. At an end opposite the carrier mount 789, the carrier arm 790 pivotally captures at a pivot 799 a branch 797A of a blade arm 797. A tab 779 is fixed to the branch 797A adjacent the pivot 799 and extends downwardly in a direction normal to the branch 797A. The tab 779 contacts a shaft-end 787A of the drive shaft 787 opposite the offset handle 794 and extending beyond the carrier 789. The branch 797A extends outwardly from the pivot 799 in a normal direction to the carrier arm 790 and couples to the blade arm 797 at an end opposite the carrier arm 790. The blade arm 797 is generally arcuately shaped and extends downwardly from the branch 797A to connect to a superior blade 796 with a tissue retractor 798 extending therefrom. Because the pivot 799 is located above the superior blade 796, a lifting force is exerted on the superior blade 796 and ribs as a spreading force from the inferior blade 783 is transmitted to the superior blade 796 through the pivot 799.

Rotation of the offset handle 794, while holding the spreader handle 793 stationary, will thread the drive screw 787 through both the spreader handle 793 and the carrier 789, and thereby cause the drive screw 787 and carrier 789 to traverse the drive base 781 as well as causing the carrier 789 to traverse the drive screw 787 in the same direction. As a result, the carrier 789 traverses the drive base 781 at approximately two-times the speed that the carrier 789 traverses the drive screw 787 and thus, the length of the shaft-end 787A extending beyond the carrier 789 will increase or decrease at approximately one-half the speed at which the carrier 789 traverses the drive base 781. Therefore, as the offset handle 794 is rotated in a direction to spread the ribs, the ribs will be raised at a rate slower than they are spread as the superior blade 796 naturally rotates about the pivot 799 as the length of the shaft-end 787A extending beyond the carrier 789 decreases. Similarly, as the offset handle 794 is rotated in a direction to lower the offset ribs, the length of the shaft-end 787A will increase, at a rate slower than the rate at which the carrier 789 traverses the drive base 781. As the length of the shaft end 787A increases, it forces the tab 779, and thus the superior blade 797, to rotate in the counterclockwise direction around the pivot 799, and thereby further lowers the ribs. Because the carrier 789 traverses the drive base 781 at a faster rate than the shaft-end 787A increases, the distance between the blades 783 and 796 along the drive base 781 tends to decrease as the ribs are lowered;"

page 70, line 3-page 71, line 10: "Turning to Figure 40, a seventeenth embodiment of the access platform 800 comprises a spreader housing 801 which includes a drive mechanism housed therein (not shown) and a drive slot 803 cut into the spreader housing 801. A spreader lever 802 is mounted on the top of the spreader housing 801 and is operably connected to the drive mechanism housed therein. An inferior blade 805 having a tissue retractor 804 extending therefrom, is interconnected to the drive mechanism via a blade arm 806. The blade arm 806 extends outwardly from the spreader housing 801 in a generally normal direction.

A pad arm 817 connects at one end, or is formed integrally therewith, to the spreader housing 801 and extends outwardly therefrom. A sternal pad 816 is integrally formed on the pad arm 817 at an end opposite the housing 801. The pad arm 817 is generally arcuate to conform to an extended rib cage due to the offset of the ribs.

A superior blade 820 having a tissue retractor 821 extending therefrom, is connected to the bottom end of a generally arcuately shaped blade arm 818. The top end of the blade arm 818 is pivotally mounted on an offset stanchion 815 that extends upwardly from the pad arm 817. A compression member 813 is pivotally connected to the top of the stanchion 815 at pivot 814 and extends inwardly from the stanchion 815 toward the lever 802 on the spreader housing 801. An offset screw 811 having a handle 812 attached to its top end, is threaded through the compression member 813 at an end opposite the pivot 814 and is rotatably captured by a bushing assembly 808 rotatably coupled to a mount 807 that extends upwardly from the spreader housing 801. A counter-lift tab 809 extends inwardly from the blade arm 818 adjacent the stanchion 815. The lift tab 809 is operably connected to the compression member 813 through an offset spring 810 mounted therebetween;"

<p>angle adjusting means for adjusting the angle of retraction of said adjustable lifter blade; whereby said blade lifts an upper portion of the ribcage to provide improved access and visibility of the intermammary artery.</p>	<p>See, e.g., page 48, lines 1-11: "Turning to Figure 28, an eleventh embodiment of the access platform 651 comprises a spreader housing 602 that includes a drive mechanism therein (not shown) and a drive slot 608 formed therein. A spreader lever 604 is mounted on top of the spreader housing 602 and is operably connected to the drive mechanism housed therein. An inferior blade 650 is interconnected to the drive mechanism via a blade arm 640 which extends outwardly to the inferior blade 650 from the spreader housing 602 in a direction generally normal to the housing 602. A tissue retractor 670 is attached to the blade 650 to assist in tissue retraction;"</p> <p>page 51; line 10-page 52, line 20: " Turning to Figure 30, a thirteenth embodiment of the access platform 655 of the present invention comprises a generally elongated drive base 601 having a blade arm 640 and a pad arm 683 extending therefrom. The blade arm 640 extends in a generally normal direction from the drive base 601, while the pad arm 683, which is generally arcuately shaped, extends longitudinally and downwardly from the drive base 601. The pad arm 683 terminates in a sternal pad 681. A threaded shaft carrier 607 extends upwardly from the drive base 601 adjacent the blade arm 640. An inferior blade 650 having a tissue retractor 670 extending therefrom attaches to the blade arm 640. In a preferred construction, the inferior blade 650, tissue retractor 670, blade arm 640, threaded shaft carrier 607, drive base 601, pad arm 683, and sternal pad 681 are formed from one-piece construction.</p> <p>A hollow threaded shaft 603 is threaded through the shaft carrier 607 and extends along the drive base 601 to rotatably attach to a hollow drive block 609. A spreader handle 605 is attached to the shaft 603 at an end opposite the drive block 609. A worm gear 697 positioned in the drive block 609, is fixed to the end of a shaft 696 that passes through the hollow threaded shaft 603 and attaches to an offset handle 695 beyond the spreader handle 605. The worm gear 697 is operably connected to an arcuate worm gear rack 698 that is positioned within the drive block 609 and connected to a branch 643 of a blade arm 642. The branch 643 of the blade arm 642 extends from the blade arm 642 in a normal direction and is pivotally mounted to the hollow drive block 609. The blade arm 642 extends downwardly from the branch 643 and attaches to a superior blade 652 with a tissue retractor 672 extending therefrom. A follower 619 extends downwardly from the base of the hollow drive block 609 and is received in a elongated drive slot 611 in the drive base 601. As the drive block 609 is transversely driven along the base 601 by the threaded shaft 603, the follower 609 slidably follows the drive slot 611 in the drive base 601;"</p>
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page 57, lines 4-22: "The offset link 632 comprises a substantially "L" shaped base 631 that extends from the pinion housing 620 at one end and terminates at the other end in a pair of parallel spaced and arcuate shaped fingers 633 and 634. A bushing 635 having a hole tapped through its center perpendicular to the bushing's 635 longitudinal axis, is rotatably captured by the fingers 633 and 634. An adjustable offset drive screw 636 is threaded through the hole in the bushing 635 and is operably connected to the shoe arm 682.

The adjustable offset drive screw 636 comprises a handle 637 attached to the top end of a jack screw 638. The base of the jack screw 638 is formed as a hemisphere 639. The hemisphere 639 operably couples with a hemispherical recess 686 cut into a boss 684 that extends outwardly from the shoe arm 682. The boss 684 is tilted upwardly at an angle \ominus relative to the longitudinal axis of the shoe arm 682. This construction ensures that the hemisphere 639 will maintain contact with the boss 684 during operation as the jack screw 638 forces the shoe arm 682 and shoe 680 to rotate downwardly in a clockwise direction;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 64, line 5-page 67, line 5: " Referring to Figure 39, a sixteenth embodiment of an access platform 780 comprises a generally elongated drive base 781 having a blade arm 782 extended generally in a normal direction from the drive base 781. A generally arcuate pad arm 786 extends generally longitudinally and downwardly from the drive base 781 and terminates at a sternal pad 785. A bearing support 791 extends upwardly from the drive base 781 adjacent the blade arm 782. An inferior blade 783 having a tissue retractor 784 extending therefrom attaches to the end of the inferior blade arm 782. In a preferred construction, the inferior blade 781, tissue retractor 784, blade arm 782, bearing support 791, drive base 781, pad arm 786 and sternal pad 785 are formed from one-piece construction.

A bearing 792 is mounted to the bearing support 791 and has a spreader handle 793 operably coupled thereto. A drive screw 787 having an offset handle 794 with a lever 795 attached to its first end, is threaded through the spreader handle 793 and freely passes through the bearing 792 and bearing support 791. The drive screw 787 extends longitudinally along the drive base 781 and is threaded through a carrier mount 789. The spreader handle 793 and the carrier mount 789 include oppositely wound threads. Rotation of the spreader handle 793 transversely drives the drive screw 787 and the carrier mount 789 mounted thereon along the drive base 781 and, thus, spreads or closes the blades 783 and 796. The carrier mount 789 includes a follower extending downwardly from its base that inserts into a drive slot 788 in the base 781. As the carrier mount 789 is translated across the drive base 781, the follower slides along the drive slot 788.

Extending upwardly and longitudinally outwardly in a direction away from the spreader handle 793, a carrier arm 790 extends from the carrier 789. At an end opposite the carrier mount 789, the carrier arm 790 pivotally captures at a pivot 799 a branch 797A of a blade arm 797. A tab 779 is fixed to the branch 797A adjacent the pivot 799 and extends downwardly in a direction normal to the branch 797A. The tab 779 contacts a shaft-end 787A of the drive shaft 787 opposite the offset handle 794 and extending beyond the carrier 789. The branch 797A extends outwardly from the pivot 799 in a normal direction to the carrier arm 790 and couples to the blade arm 797 at an end opposite the carrier arm 790. The blade arm 797 is generally arcuately shaped and extends downwardly from the branch 797A to connect to a superior blade 796 with a tissue retractor 798 extending therefrom. Because the pivot 799 is located above the superior blade 796, a lifting force is exerted on the superior blade 796 and ribs as a spreading force from the inferior blade 783 is transmitted to the superior blade 796 through the pivot 799.

Rotation of the offset handle 794, while holding the spreader handle 793 stationary, will thread the drive screw 787 through both the spreader handle 793 and the carrier 789, and thereby cause the drive screw 787 and carrier 789 to traverse the drive base 781 as well as causing the carrier 789 to traverse the drive screw 787 in the same direction. As a result, the carrier 789 traverses the drive base 781 at approximately two-times the speed that the carrier 789 traverses the drive screw 787 and thus, the length of the shaft-end 787A extending beyond the carrier 789 will increase or decrease at approximately one-half the speed at which the carrier 789 traverses the drive base 781. Therefore, as the offset handle 794 is rotated in a direction to spread the ribs, the ribs will be raised at a rate slower than they are spread as the superior blade 796 naturally rotates about the pivot 799 as the length of the shaft-end 787A extending beyond the carrier 789 decreases. Similarly, as the offset handle 794 is rotated in a direction to lower the offset ribs, the length of the shaft-end 787A will increase, at a rate slower than the rate at which the carrier 789 traverses the drive base 781. As the length of the shaft end 787A increases, it forces the tab 779, and thus the superior blade 797, to rotate in the counterclockwise direction around the pivot 799, and thereby further lowers the ribs. Because the carrier 789 traverses the drive base 781 at a faster rate than the shaft-end 787A increases, the distance between the blades 783 and 796 along the drive base 781 tends to decrease as the ribs are lowered;"

page 70, line 3-page 71, line 10: "Turning to Figure 40, a seventeenth embodiment of the access platform 800 comprises a spreader housing 801 which includes a drive mechanism housed therein (not shown) and a drive slot 803 cut into the spreader housing 801. A spreader lever 802 is mounted on the top of the spreader housing 801 and is operably connected to the drive mechanism housed therein. An inferior blade 805 having a tissue retractor 804 extending therefrom, is interconnected to the drive mechanism via a blade arm 806. The blade arm 806 extends outwardly from the spreader housing 801 in a generally normal direction.

A pad arm 817 connects at one end, or is formed integrally therewith, to the spreader housing 801 and extends outwardly therefrom. A sternal pad 816 is integrally formed on the pad arm 817 at an end opposite the housing 801. The pad arm 817 is generally arcuate to conform to an extended rib cage due to the offset of the ribs.

A superior blade 820 having a tissue retractor 821 extending therefrom, is connected to the bottom end of a generally arcuately shaped blade arm 818. The top end of the blade arm 818 is pivotally mounted on an offset stanchion 815 that extends upwardly from the pad arm 817. A compression member 813 is pivotally connected to the top of the stanchion 815 at pivot 814 and extends inwardly from the stanchion 815 toward the lever 802 on the spreader housing 801. An offset screw 811 having a handle 812 attached to its top end, is threaded through the compression member 813 at an end opposite the pivot 814 and is rotatably captured by a bushing assembly 808 rotatably coupled to a mount 807 that extends upwardly from the spreader housing 801. A counter-lift tab 809 extends inwardly from the blade arm 818 adjacent the stanchion 815. The lift tab 809 is operably connected to the compression member 813 through an offset spring 810 mounted therebetween;"

<p>92. The retractor according to claim 90 in which said adjustable lifter blade has a curved portion and a tongue portion; said tongue portion being tapered toward a tip.</p>	<p>See, e.g., page 21, lines 6-12: " Referring to Figure 2, the blades 50 and 51 preferably include elongated vanes 52 and 53, which slide beneath a plurality of the patient's ribs, and recessed arcuate throats 54 and 55 that receive the patient's ribs that are adjacent to the chest incision. The benefits of the recessed throats 54 and 55 and the elongated vanes 52 and 53 will be discussed below with regard to the operation of the access platform 10;"</p>
	<p>page 30, line 16-page 31, line 2: "The elongated vane construction of the blades 50 and 51 advantageously enables the access platform 10 to vertically raise a plurality of the patient's ribs R to cause a greater "tunnel" effect under a patient's rib cage and, thus, increases the surgeon's working area and visual access to the IMA. The recessed throat construction of the blades 50 and 51 advantageously enables the access platform 10 to vertically displace the opposite rib that is adjacent to the chest incision downwardly to further increase the surgeon's visual access. This combined motion helps to create an optimum tunnel;"</p>
	<p>page 55 lines 11-19: "The superior blade 652 which is advantageously located below and interconnected to the moveable pivot 624, comprises a recessed throat 654 to capture a rib adjacent to an incision in the patient's chest cavity and a pair of elongated vanes 656 and 657 used to offset a plurality of the patient's ribs. The inferior blade 650 which is interconnected to the fixed pivot 616 comprises a recessed throat 653 used to capture a rib adjacent to an incision in the patient's chest cavity;"</p>
	<p>page 87, line 19-page 88, line 18: "Referring to Figures 71-74, the blades utilized with the access platform embodiments described herein are preferably interchangeable from a spreader-type blade to an offsetting-type blade. In Figure 71, an elongated vane member 561 folds like a pocket knife into a slot 562 formed in a spreader blade 560. In Figure 72, an elongated member 561 is extensible and flexible. The elongated member 561 can be hidden substantially within a slot 562 formed in a spreader blade 560, or extended out the top or bottom of the slot 562 for rib lifting or tissue retraction. The elongated member 561 is flexible in concavity but is prevented by straps or hinges from flexing in the opposite direction past straight.</p> <p>In Figures 73 and 74, an offset type blade 565 is shown to comprise an elongated vane 563 and a recess in the throat area 568 sized to receive a spreader blade 564. A groove 567 is cut into the offset blade 565 at one end of the recess and a tongue 570 extending from the offset type blade 565 is formed at the other end of the recess. A tongue 569 extending from the lower portion of the spreader blade 564 mates with the groove 567 in the offset blade 565. A groove 566 formed in the top part of the spreader blade 564 mates with the tongue 570 of the offset-type blade 565. This tongue and groove assembly detachably couples the spreader and offset-type blades together to interchange a spreader blade 564 into an offset-type blade 565;"</p>

<p>94. The retractor according to claim 89 in which said retractor tilting means comprises an adjustable support tower attached to a free end of said crossbar on said retractor frame for raising or lowering the retractor frame to raise an upper portion of the ribcage to provide improved access And visibility of said intermammary artery.</p>	<p>See, e.g., page 22, lines 3-24: "The support pads 80 and 81 are connected to adjustable arms 86 and 87 by swivel connectors 82 and 83 that are preferably constructed as ball and socket type connectors 84 and 85. The adjustable arms 86 and 87 preferably include external shafts 88 and 89 slidably received over and operably connected to internal shafts 98 and 99. The external shafts 88 and 89 are preferably operably connected to the internal shafts 98 and 99 via a ratchet lever mechanism (not shown). The internal shafts 98 and 99 of the adjustable arms 86 and 87 are further connected to lock positioners 90 and 91. The lock positioners 90 and 91, which are attached to the torque bases 32 and 33, comprise a ratchet or a wrap spring type mechanism (not shown) or, alternatively, comprise opposing face gears 94 and 96, 95 and 97. Tabs 92 and 93 rotate and cooperate with cammed or serrated surfaces 36 and 37 on the outer face of the outer face gears 94 and 95 to engage and disengage the opposing face gears 94 and 96, 95 and 97. Thus, when the tabs 92 and 93 are rotated to disengage the face gears 94 and 96, 95 and 97, the support pads 80 and 81 can be rotated to a desired position. Once the support pads 80 and 81 are in position, the tabs 92 and 93 are rotated to engage the face gears 94 and 96, 95 and 97 and, thus, lock the support pads 80 and 81 in place;"</p> <p>page 33, line 15- page 34, line 5: " Preferably, one end of the horizontally disposed rack 120 is connected to a slide 172 of a lock positioner 171. The slide 172 is slidably received over a vertically disposed support pad stanchion 167. The stanchion 167 has ratchet gear teeth 173 formed thereon which cooperate with a pawl 174 attached to the slide 172 to adjustably position the support pad 161. The support pad 161 is adjustably connected to the stanchion 167 by a swivel connector 163.</p> <p>The opposing end of the horizontally disposed rack 120 is preferably connected to a support pad link 176 via a lockable ball and socket joint 177. The support pad link 176 is further connected to a second support pad link 175 via a hinge joint 178. This link and joint assembly allows for the multiple positioning of the support pad 160. The support pad 160 is further connected to the support pad link 175 via a swivel connector 162;"</p>
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page 45, line 3-page 46, line 21: " Turning to Figure 26, a ninth embodiment of the access platform 410 of the present invention is shown. The access platform 410 mounts to the table or rail via slides 438 and 440 that are locked in place by positioners 450 and 452. The slides 438 and 440 rotatably retain pinions 442 and 444 driven by levers 446 and 448 and slidably receive stanchion racks 430 and 432. The stanchion racks 430 and 432 include rack gears 434 and 436 that operably couple with pinions 442 and 444. The levers 446 and 448 are rotated to drive the pinions 442 and 444 along rack gears 434 and 436 to adjust the height of the stanchion racks 430 and 432 relative to the table or patient, or to vertically offset blades 470 and 472 relative to one another.

A pinion housing 422 is slidably attached to the stanchion rack 432 towards its upper end. A rack 420 is attached at one end to stanchion rack 430 and is slidably received in the pinion housing 422. A pinion 424 driven by a lever 426 is rotatably retained in the pinion housing 422 and operably connected to the rack 420. The lever 426 is rotated to drive the pinion 424 along the rack 420 to spread apart the stanchion racks 430 and 432 and effectively a patient's ribs.

Torsional members 460 and 462 are attached to the top of the stanchion racks 430 and 432. Blade arms 474 and 476 extend outwardly from torsional members and attach to the blades 470 and 472. The torsional members comprise inner hubs 461 and 465 rotatably received in and operably connected to outer hubs 463 and 467. Locking levers 464 and 466 lock the inner hubs 461 and 465 in place relative to the outer hubs 463 and 467.

In operation, the access platform 410 is positioned such that the blades 470 and 472 can be inserted into an incision in a patient's chest and then attached to the blade arms 474 and 476. Once the blades 470 and 472 are positioned in the incision and attached to the blade arms 474 and 476, the lever 426 is rotated to spread the blades 470 and 472 and the patient's ribs apart. The blades 470 and 472 can be effectively offset by rotating the inner hubs 461 and 465 relative to the outer hubs 463 and 467. While the blades 470 and 472 are rotated, the stanchion racks 430 and 432 can be raised or lowered by rotating levers 446 and 448 to drive pinions 442 and 444. By raising or lowering the stanchion racks 430 and 432, the blades 470 and 472 can be effectively raised or lowered relative to one another to further offset the blades 470 and 472 relative to one another. A wrench 468 is utilized to rotate the inner hubs 461 and 465 relative to the outer hubs 463 and 467;"

page 56, line 3-page 57, line 22: " The branch portion 643 of the blade arm 642 that is interconnected to the moveable pivot 624 extends higher vertically than the branch portion 641 of the blade arm 640 that is interconnected to the fixed pivot 616 when the blades 650 and 652 are substantially level (see Figure 29). This construction tends to increase the moment about the moveable pivot 624 caused by the offset of the movable pivot from the center-of-effort of the spreading force at the blades 650 and 652. Because the movable pivot 624 is located above the superior blade 652, a lifting force is naturally exerted on the superior blade 652 and ribs as spreading occurs.

To add additional offset of the superior blade 652 once the blades 650 and 652 are separated and offset, a vertical displacement component 630 is included on the access platform 610. The vertical displacement component 630 comprises a rib compression shoe 680, a substantially "S" shaped shoe arm 682 connected to the shoe 680 at one end and pivotally connected to the stem 646 of the blade arm 642 at the other end, and an adjustable offset link 632 connected to the pinion housing 620 and operably connected to the shoe arm 682 and shoe 680;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 64, line 5-page 67, line 5: " Referring to Figure 39, a sixteenth embodiment of an access platform 780 comprises a generally elongated drive base 781 having a blade arm 782 extended generally in a normal direction from the drive base 781. A generally arcuate pad arm 786 extends generally longitudinally and downwardly from the drive base 781 and terminates at a sternal pad 785. A bearing support 791 extends upwardly from the drive base 781 adjacent the blade arm 782. An inferior blade 783 having a tissue retractor 784 extending therefrom attaches to the end of the inferior blade arm 782. In a preferred construction, the inferior blade 781, tissue retractor 784, blade arm 782, bearing support 791, drive base 781, pad arm 786 and sternal pad 785 are formed from one-piece construction.

A bearing 792 is mounted to the bearing support 791 and has a spreader handle 793 operably coupled thereto. A drive screw 787 having an offset handle 794 with a lever 795 attached to its first end, is threaded through the spreader handle 793 and freely passes through the bearing 792 and bearing support 791. The drive screw 787 extends longitudinally along the drive base 781 and is threaded through a carrier mount 789. The spreader handle 793 and the carrier mount 789 include oppositely wound threads. Rotation of the spreader handle 793 transversely drives the drive screw 787 and the carrier mount 789 mounted thereon along the drive base 781 and, thus, spreads or closes the blades 783 and 796. The carrier mount 789 includes a follower extending downwardly from its base that inserts into a drive slot 788 in the base 781. As the carrier mount 789 is translated across the drive base 781, the follower slides along the drive slot 788.

Extending upwardly and longitudinally outwardly in a direction away from the spreader handle 793, a carrier arm 790 extends from the carrier 789. At an end opposite the carrier mount 789, the carrier arm 790 pivotally captures at a pivot 799 a branch 797A of a blade arm 797. A tab 779 is fixed to the branch 797A adjacent the pivot 799 and extends downwardly in a direction normal to the branch 797A. The tab 779 contacts a shaft-end 787A of the drive shaft 787 opposite the offset handle 794 and extending beyond the carrier 789. The branch 797A extends outwardly from the pivot 799 in a normal direction to the carrier arm 790 and couples to the blade arm 797 at an end opposite the carrier arm 790. The blade arm 797 is generally arcuately shaped and extends downwardly from the branch 797A to connect to a superior blade 796 with a tissue retractor 798 extending therefrom. Because the pivot 799 is located above the superior blade 796, a lifting force is exerted on the superior blade 796 and ribs as a spreading force from the inferior blade 783 is transmitted to the superior blade 796 through the pivot 799.

	<p>Rotation of the offset handle 794, while holding the spreader handle 793 stationary, will thread the drive screw 787 through both the spreader handle 793 and the carrier 789, and thereby cause the drive screw 787 and carrier 789 to traverse the drive base 781 as well as causing the carrier 789 to traverse the drive screw 787 in the same direction. As a result, the carrier 789 traverses the drive base 781 at approximately two-times the speed that the carrier 789 traverses the drive screw 787 and thus, the length of the shaft-end 787A extending beyond the carrier 789 will increase or decrease at approximately one-half the speed at which the carrier 789 traverses the drive base 781. Therefore, as the offset handle 794 is rotated in a direction to spread the ribs, the ribs will be raised at a rate slower than they are spread as the superior blade 796 naturally rotates about the pivot 799 as the length of the shaft-end 787A extending beyond the carrier 789 decreases. Similarly, as the offset handle 794 is rotated in a direction to lower the offset ribs, the length of the shaft-end 787A will increase, at a rate slower than the rate at which the carrier 789 traverses the drive base 781. As the length of the shaft end 787A increases, it forces the tab 779, and thus the superior blade 797, to rotate in the counterclockwise direction around the pivot 799, and thereby further lowers the ribs. Because the carrier 789 traverses the drive base 781 at a faster rate than the shaft-end 787A increases, the distance between the blades 783 and 796 along the drive base 781 tends to decrease as the ribs are lowered;"</p>
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<p>95. The retractor according to claim 94 in which said adjustable support tower comprises a support bar mounted on a free end of said retractor crossbar:</p>	<p>See, e.g., page 45, line 3-page 46, line 21: " Turning to Figure 26, a ninth embodiment of the access platform 410 of the present invention is shown. The access platform 410 mounts to the table or rail via slides 438 and 440 that are locked in place by positioners 450 and 452. The slides 438 and 440 rotatably retain pinions 442 and 444 driven by levers 446 and 448 and slidably receive stanchion racks 430 and 432. The stanchion racks 430 and 432 include rack gears 434 and 436 that operably couple with pinions 442 and 444. The levers 446 and 448 are rotated to drive the pinions 442 and 444 along rack gears 434 and 436 to adjust the height of the stanchion racks 430 and 432 relative to the table or patient, or to vertically offset blades 470 and 472 relative to one another.</p>
<p>a support shaft;</p>	<p>A pinion housing 422 is slidably attached to the stanchion rack 432 towards its upper end. A rack 420 is attached at one end to stanchion rack 430 and is slidably received in the pinion housing 422. A pinion 424 driven by a lever 426 is rotatably retained in the pinion housing 422 and operably connected to the rack 420. The lever 426 is rotated to drive the pinion 424 along the rack 420 to spread apart the stanchion racks 430 and 432 and effectively a patient's ribs.</p>
	<p>Torsional members 460 and 462 are attached to the top of the stanchion racks 430 and 432. Blade arms 474 and 476 extend outwardly from torsional members and attach to the blades 470 and 472. The torsional members comprise inner hubs 461 and 465 rotatably received in and operably connected to outer hubs 463 and 467. Locking levers 464 and 466 lock the inner hubs 461 and 465 in place relative to the outer hubs 463 and 467.</p>
	<p>In operation, the access platform 410 is positioned such that the blades 470 and 472 can be inserted into an incision in a patient's chest and then attached to the blade arms 474 and 476. Once the blades 470 and 472 are positioned in the incision and attached to the blade arms 474 and 476, the lever 426 is rotated to spread the blades 470 and 472 and the patient's ribs apart. The blades 470 and 472 can be effectively offset by rotating the inner hubs 461 and 465 relative to the outer hubs 463 and 467. While the blades 470 and 472 are rotated, the stanchion racks 430 and 432 can be raised or lowered by rotating levers 486 and 488 to drive pinions 442 and 444. By raising or lowering the stanchion racks 430 and 432, the blades 470 and 472 can be effectively raised or lowered relative to one another to further offset the blades 470 and 472 relative to one another. A wrench 468 is utilized to rotate the inner hubs 461 and 465 relative to the outer hubs 463 and 467;"</p>

clamp means for clamping and adjustably positioning said support shaft on said support bar to raise or lower said retractor.

See, e.g., page 45, line 3-page 46, line 21: " Turning to Figure 26, a ninth embodiment of the access platform 410 of the present invention is shown. The access platform 410 mounts to the table or rail via slides 438 and 440 that are locked in place by positioners 450 and 452. The slides 438 and 440 rotatably retain pinions 442 and 444 driven by levers 446 and 448 and slidably receive stanchion racks 430 and 432. The stanchion racks 430 and 432 include rack gears 434 and 436 that operably couple with pinions 442 and 444. The levers 446 and 448 are rotated to drive the pinions 442 and 444 along rack gears 434 and 436 to adjust the height of the stanchion racks 430 and 432 relative to the table or patient, or to vertically offset blades 470 and 472 relative to one another.

A pinion housing 422 is slidably attached to the stanchion rack 432 towards its upper end. A rack 420 is attached at one end to stanchion rack 430 and is slidably received in the pinion housing 422. A pinion 424 driven by a lever 426 is rotatably retained in the pinion housing 422 and operably connected to the rack 420. The lever 426 is rotated to drive the pinion 424 along the rack 420 to spread apart the stanchion racks 430 and 432 and effectively a patient's ribs.

Torsional members 460 and 462 are attached to the top of the stanchion racks 430 and 432. Blade arms 474 and 476 extend outwardly from torsional members and attach to the blades 470 and 472. The torsional members comprise inner hubs 461 and 465 rotatably received in and operably connected to outer hubs 463 and 467. Locking levers 464 and 466 lock the inner hubs 461 and 465 in place relative to the outer hubs 463 and 467.

In operation, the access platform 410 is positioned such that the blades 470 and 472 can be inserted into an incision in a patient's chest and then attached to the blade arms 474 and 476. Once the blades 470 and 472 are positioned in the incision and attached to the blade arms 474 and 476, the lever 426 is rotated to spread the blades 470 and 472 and the patient's ribs apart. The blades 470 and 472 can be effectively offset by rotating the inner hubs 461 and 465 relative to the outer hubs 463 and 467. While the blades 470 and 472 are rotated, the stanchion racks 430 and 432 can be raised or lowered by rotating levers 486 and 488 to drive pinions 442 and 444. By raising or lowering the stanchion racks 430 and 432, the blades 470 and 472 can be effectively raised or lowered relative to one another to further offset the blades 470 and 472 relative to one another. A wrench 468 is utilized to rotate the inner hubs 461 and 465 relative to the outer hubs 463 and 467;"

96. The retractor according to claim 95 including a footpad on an end of said support shaft.

See, e.g., page 22, lines 3-24: "The support pads 80 and 81 are connected to adjustable arms 86 and 87 by swivel connectors 82 and 83 that are preferably constructed as ball and socket type connectors 84 and 85. The adjustable arms 86 and 87 preferably include external shafts 88 and 89 slidably received over and operably connected to internal shafts 98 and 99. The external shafts 88 and 89 are preferably operably connected to the internal shafts 98 and 99 via a ratchet lever mechanism (not shown). The internal shafts 98 and 99 of the adjustable arms 86 and 87 are further connected to lock positioners 90 and 91. The lock positioners 90 and 91, which are attached to the torque bases 32 and 33, comprise a ratchet or a wrap spring type mechanism (not shown) or, alternatively, comprise opposing face gears 94 and 96, 95 and 97. Tabs 92 and 93 rotate and cooperate with cammed or serrated surfaces 36 and 37 on the outer face of the outer face gears 94 and 95 to engage and disengage the opposing face gears 94 and 96, 95 and 97. Thus, when the tabs 92 and 93 are rotated to disengage the face gears 94 and 96, 95 and 97, the support pads 80 and 81 can be rotated to a desired position. Once the support pads 80 and 81 are in position, the tabs 92 and 93 are rotated to engage the face gears 94 and 96, 95 and 97 and, thus, lock the support pads 80 and 81 in place;"

page 56, line 3-page 57, line 22: " The branch portion 643 of the blade arm 642 that is interconnected to the moveable pivot 624 extends higher vertically than the branch portion 641 of the blade arm 640 that is interconnected to the fixed pivot 616 when the blades 650 and 652 are substantially level (see Figure 29). This construction tends to increase the moment about the moveable pivot 624 caused by the offset of the movable pivot from the center-of-effort of the spreading force at the blades 650 and 652. Because the movable pivot 624 is located above the superior blade 652, a lifting force is naturally exerted on the superior blade 652 and ribs as spreading occurs.

To add additional offset of the superior blade 652 once the blades 650 and 652 are separated and offset, a vertical displacement component 630 is included on the access platform 610. The vertical displacement component 630 comprises a rib compression shoe 680, a substantially "S" shaped shoe arm 682 connected to the shoe 680 at one end and pivotally connected to the stem 646 of the blade arm 642 at the other end, and an adjustable offset link 632 connected to the pinion housing 620 and operably connected to the shoe arm 682 and shoe 680;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 64, line 5-page 67, line 5: " Referring to Figure 39, a sixteenth embodiment of an access platform 780 comprises a generally elongated drive base 781 having a blade arm 782 extended generally in a normal direction from the drive base 781. A generally arcuate pad arm 786 extends generally longitudinally and downwardly from the drive base 781 and terminates at a sternal pad 785. A bearing support 791 extends upwardly from the drive base 781 adjacent the blade arm 782. An inferior blade 783 having a tissue retractor 784 extending therefrom attaches to the end of the inferior blade arm 782. In a preferred construction, the inferior blade 781, tissue retractor 784, blade arm 782, bearing support 791, drive base 781, pad arm 786 and sternal pad 785 are formed from one-piece construction.

A bearing 792 is mounted to the bearing support 791 and has a spreader handle 793 operably coupled thereto. A drive screw 787 having an offset handle 794 with a lever 795 attached to its first end, is threaded through the spreader handle 793 and freely passes through the bearing 792 and bearing support 791. The drive screw 787 extends longitudinally along the drive base 781 and is threaded through a carrier mount 789. The spreader handle 793 and the carrier mount 789 include oppositely wound threads. Rotation of the spreader handle 793 transversely drives the drive screw 787 and the carrier mount 789 mounted thereon along the drive base 781 and, thus, spreads or closes the blades 783 and 796. The carrier mount 789 includes a follower extending downwardly from its base that inserts into a drive slot 788 in the base 781. As the carrier mount 789 is translated across the drive base 781, the follower slides along the drive slot 788.

Extending upwardly and longitudinally outwardly in a direction away from the spreader handle 793, a carrier arm 790 extends from the carrier 789. At an end opposite the carrier mount 789, the carrier arm 790 pivotally captures at a pivot 799 a branch 797A of a blade arm 797. A tab 779 is fixed to the branch 797A adjacent the pivot 799 and extends downwardly in a direction normal to the branch 797A. The tab 779 contacts a shaft-end 787A of the drive shaft 787 opposite the offset handle 794 and extending beyond the carrier 789. The branch 797A extends outwardly from the pivot 799 in a normal direction to the carrier arm 790 and couples to the blade arm 797 at an end opposite the carrier arm 790. The blade arm 797 is generally arcuately shaped and extends downwardly from the branch 797A to connect to a superior blade 796 with a tissue retractor 798 extending therefrom. Because the pivot 799 is located above the superior blade 796, a lifting force is exerted on the superior blade 796 and ribs as a spreading force from the inferior blade 783 is transmitted to the superior blade 796 through the pivot 799.

Rotation of the offset handle 794, while holding the spreader handle 793 stationary, will thread the drive screw 787 through both the spreader handle 793 and the carrier 789, and thereby cause the drive screw 787 and carrier 789 to traverse the drive base 781 as well as causing the carrier 789 to traverse the drive screw 787 in the same direction. As a result, the carrier 789 traverses the drive base 781 at approximately two-times the speed that the carrier 789 traverses the drive screw 787 and thus, the length of the shaft-end 787A extending beyond the carrier 789 will increase or decrease at approximately one-half the speed at which the carrier 789 traverses the drive base 781. Therefore, as the offset handle 794 is rotated in a direction to spread the ribs, the ribs will be raised at a rate slower than they are spread as the superior blade 796 naturally rotates about the pivot 799 as the length of the shaft-end 787A extending beyond the carrier 789 decreases. Similarly, as the offset handle 794 is rotated in a direction to lower the offset ribs, the length of the shaft-end 787A will increase, at a rate slower than the rate at which the carrier 789 traverses the drive base 781. As the length of the shaft end 787A increases, it forces the tab 779, and thus the superior blade 797, to rotate in the counterclockwise direction around the pivot 799, and thereby further lowers the ribs. Because the carrier 789 traverses the drive base 781 at a faster rate than the shaft-end 787A increases, the distance between the blades 783 and 796 along the drive base 781 tends to decrease as the ribs are lowered;"

<p>100. The retractor according to claim 90 including means for pivotally mounting said adjustable lifter blade on said movable retractor arm.</p>	<p>See, e.g., page 48, lines 1-11: "Turning to Figure 28, an eleventh embodiment of the access platform 651 comprises a spreader housing 602 that includes a drive mechanism therein (not shown) and a drive slot 608 formed therein. A spreader lever 604 is mounted on top of the spreader housing 602 and is operably connected to the drive mechanism housed therein. An inferior blade 650 is interconnected to the drive mechanism via a blade arm 640 which extends outwardly to the inferior blade 650 from the spreader housing 602 in a direction generally normal to the housing 602. A tissue retractor 670 is attached to the blade 650 to assist in tissue retraction;"</p>
	<p>page 51, line 10-page 52, line 20: " Turning to Figure 30, a thirteenth embodiment of the access platform 655 of the present invention comprises a generally elongated drive base 601 having a blade arm 640 and a pad arm 683 extending therefrom. The blade arm 640 extends in a generally normal direction from the drive base 601, while the pad arm 683, which is generally arcuately shaped, extends longitudinally and downwardly from the drive base 601. The pad arm 683 terminates in a sternal pad 681. A threaded shaft carrier 607 extends upwardly from the drive base 601 adjacent the blade arm 640. An inferior blade 650 having a tissue retractor 670 extending therefrom attaches to the blade arm 640. In a preferred construction, the inferior blade 650, tissue retractor 670, blade arm 640, threaded shaft carrier 607, drive base 601, pad arm 683, and sternal pad 681 are formed from one-piece construction.</p> <p>A hollow threaded shaft 603 is threaded through the shaft carrier 607 and extends along the drive base 601 to rotatably attach to a hollow drive block 609. A spreader handle 605 is attached to the shaft 603 at an end opposite the drive block 609. A worm gear 697 positioned in the drive block 609, is fixed to the end of a shaft 696 that passes through the hollow threaded shaft 603 and attaches to an offset handle 695 beyond the spreader handle 605. The worm gear 697 is operably connected to an arcuate worm gear rack 698 that is positioned within the drive block 609 and connected to a branch 643 of a blade arm 642. The branch 643 of the blade arm 642 extends from the blade arm 642 in a normal direction and is pivotally mounted to the hollow drive block 609. The blade arm 642 extends downwardly from the branch 643 and attaches to a superior blade 652 with a tissue retractor 672 extending therefrom. A follower 619 extends downwardly from the base of the hollow drive block 609 and is received in a elongated drive slot 611 in the drive base 601. As the drive block 609 is transversely driven along the base 601 by the threaded shaft 603, the follower 609 slidably follows the drive slot 611 in the drive base 601;"</p>

page 54, line 16-page 55, line 19: "Referring to Figures 31 and 32, a fourteenth embodiment of the access platform 610 of the present invention comprises a spreader component 612 that includes a rack 613, a spreader base 614 attached to one end of the rack 613 and a pinion housing 620 slidably received over the rack 613. A pinion 621 that is driven by a lever 622 is rotatably retained in the pinion housing 620 and operably connected to the rack 613.

A fixed pivot 616 having a socket 618 formed therein, extends from the spreader base 614. A fixed pivot lock 615 with a lock screw 617 is fixedly connected to the fixed pivot 616. A moveable pivot 624 having a socket 625 formed therein, extends from the housing 620. Rotatably and releasably received in and extending from the sockets 618 and 625 are stem portions 644 and 646 of a pair of blade arms 640 and 642, respectively. The stem 644 that is received in the socket 618 of the fixed pivot 616 includes a stop 645 formed on its exterior to abut the fixed pivot lock 615 and stop the travel of the stem 644. Branch portions 641 and 643 of the blade arms 640 and 642 extend downwardly from the stem portions 644 and 646 and attach to inferior and superior blades 650 and 652, respectively. The superior blade 652 which is advantageously located below and interconnected to the moveable pivot 624, comprises a recessed throat 654 to capture a rib adjacent to an incision in the patient's chest cavity and a pair of elongated vanes 656 and 657 used to offset a plurality of the patient's ribs. The inferior blade 650 which is interconnected to the fixed pivot 616 comprises a recessed throat 653 used to capture a rib adjacent to an incision in the patient's chest cavity;"

page 56, lines 3-13: " The branch portion 643 of the blade arm 642 that is interconnected to the moveable pivot 624 extends higher vertically than the branch portion 641 of the blade arm 640 that is interconnected to the fixed pivot 616 when the blades 650 and 652 are substantially level (see Figure 29). This construction tends to increase the moment about the moveable pivot 624 caused by the offset of the movable pivot from the center-of-effort of the spreading force at the blades 650 and 652. Because the movable pivot 624 is located above the superior blade 652, a lifting force is naturally exerted on the superior blade 652 and ribs as spreading occurs;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 64, line 5-page 67, line 5: " Referring to Figure 39, a sixteenth embodiment of an access platform 780 comprises a generally elongated drive base 781 having a blade arm 782 extended generally in a normal direction from the drive base 781. A generally arcuate pad arm 786 extends generally longitudinally and downwardly from the drive base 781 and terminates at a sternal pad 785. A bearing support 791 extends upwardly from the drive base 781 adjacent the blade arm 782. An inferior blade 783 having a tissue retractor 784 extending therefrom attaches to the end of the inferior blade arm 782. In a preferred construction, the inferior blade 781, tissue retractor 784, blade arm 782, bearing support 791, drive base 781, pad arm 786 and sternal pad 785 are formed from one-piece construction.

A bearing 792 is mounted to the bearing support 791 and has a spreader handle 793 operably coupled thereto. A drive screw 787 having an offset handle 794 with a lever 795 attached to its first end, is threaded through the spreader handle 793 and freely passes through the bearing 792 and bearing support 791. The drive screw 787 extends longitudinally along the drive base 781 and is threaded through a carrier mount 789. The spreader handle 793 and the carrier mount 789 include oppositely wound threads. Rotation of the spreader handle 793 transversely drives the drive screw 787 and the carrier mount 789 mounted thereon along the drive base 781 and, thus, spreads or closes the blades 783 and 796. The carrier mount 789 includes a follower extending downwardly from its base that inserts into a drive slot 788 in the base 781. As the carrier mount 789 is translated across the drive base 781, the follower slides along the drive slot 788.

Extending upwardly and longitudinally outwardly in a direction away from the spreader handle 793, a carrier arm 790 extends from the carrier 789. At an end opposite the carrier mount 789, the carrier arm 790 pivotally captures at a pivot 799 a branch 797A of a blade arm 797. A tab 779 is fixed to the branch 797A adjacent the pivot 799 and extends downwardly in a direction normal to the branch 797A. The tab 779 contacts a shaft-end 787A of the drive shaft 787 opposite the offset handle 794 and extending beyond the carrier 789. The branch 797A extends outwardly from the pivot 799 in a normal direction to the carrier arm 790 and couples to the blade arm 797 at an end opposite the carrier arm 790. The blade arm 797 is generally arcuately shaped and extends downwardly from the branch 797A to connect to a superior blade 796 with a tissue retractor 798 extending therefrom. Because the pivot 799 is located above the superior blade 796, a lifting force is exerted on the superior blade 796 and ribs as a spreading force from the inferior blade 783 is transmitted to the superior blade 796 through the pivot 799.

Rotation of the offset handle 794, while holding the spreader handle 793 stationary, will thread the drive screw 787 through both the spreader handle 793 and the carrier 789, and thereby cause the drive screw 787 and carrier 789 to traverse the drive base 781 as well as causing the carrier 789 to traverse the drive screw 787 in the same direction. As a result, the carrier 789 traverses the drive base 781 at approximately two-times the speed that the carrier 789 traverses the drive screw 787 and thus, the length of the shaft-end 787A extending beyond the carrier 789 will increase or decrease at approximately one-half the speed at which the carrier 789 traverses the drive base 781. Therefore, as the offset handle 794 is rotated in a direction to spread the ribs, the ribs will be raised at a rate slower than they are spread as the superior blade 796 naturally rotates about the pivot 799 as the length of the shaft-end 787A extending beyond the carrier 789 decreases. Similarly, as the offset handle 794 is rotated in a direction to lower the offset ribs, the length of the shaft-end 787A will increase, at a rate slower than the rate at which the carrier 789 traverses the drive base 781. As the length of the shaft end 787A increases, it forces the tab 779, and thus the superior blade 797, to rotate in the counterclockwise direction around the pivot 799, and thereby further lowers the ribs. Because the carrier 789 traverses the drive base 781 at a faster rate than the shaft-end 787A increases, the distance between the blades 783 and 796 along the drive base 781 tends to decrease as the ribs are lowered;"

page 70, line 3-page 71, line 10: "Turning to Figure 40, a seventeenth embodiment of the access platform 800 comprises a spreader housing 801 which includes a drive mechanism housed therein (not shown) and a drive slot 803 cut into the spreader housing 801. A spreader lever 802 is mounted on the top of the spreader housing 801 and is operably connected to the drive mechanism housed therein. An inferior blade 805 having a tissue retractor 804 extending therefrom, is interconnected to the drive mechanism via a blade arm 806. The blade arm 806 extends outwardly from the spreader housing 801 in a generally normal direction.

A pad arm 817 connects at one end, or is formed integrally therewith, to the spreader housing 801 and extends outwardly therefrom. A sternal pad 816 is integrally formed on the pad arm 817 at an end opposite the housing 801. The pad arm 817 is generally arcuate to conform to an extended rib cage due to the offset of the ribs.

A superior blade 820 having a tissue retractor 821 extending therefrom, is connected to the bottom end of a generally arcuately shaped blade arm 818. The top end of the blade arm 818 is pivotally mounted on an offset stanchion 815 that extends upwardly from the pad arm 817. A compression member 813 is pivotally connected to the top of the stanchion 815 at pivot 814 and extends inwardly from the stanchion 815 toward the lever 802 on the spreader housing 801. An offset screw 811 having a handle 812 attached to its top end, is threaded through the compression member 813 at an end opposite the pivot 814 and is rotatably captured by a bushing assembly 808 rotatably coupled to a mount 807 that extends upwardly from the spreader housing 801. A counter-lift tab 809 extends inwardly from the blade arm 818 adjacent the stanchion 815. The lift tab 809 is operably connected to the compression member 813 through an offset spring 810 mounted therebetween;"

<p>102. The retractor according to claim 89 in which said adjustable lifter blade is self-adjusting.</p>	<p>See, e.g., page 54, line 16-page 55, line 19: "Referring to Figures 31 and 32, a fourteenth embodiment of the access platform 610 of the present invention comprises a spreader component 612 that includes a rack 613, a spreader base 614 attached to one end of the rack 613 and a pinion housing 620 slidably received over the rack 613. A pinion 621 that is driven by a lever 622 is rotatably retained in the pinion housing 620 and operably connected to the rack 613.</p> <p>A fixed pivot 616 having a socket 618 formed therein, extends from the spreader base 614. A fixed pivot lock 615 with a lock screw 617 is fixedly connected to the fixed pivot 616. A moveable pivot 624 having a socket 625 formed therein, extends from the housing 620. Rotatably and releasably received in and extending from the sockets 618 and 625 are stem portions 644 and 646 of a pair of blade arms 640 and 642, respectively. The stem 644 that is received in the socket 618 of the fixed pivot 616 includes a stop 645 formed on its exterior to abut the fixed pivot lock 615 and stop the travel of the stem 644. Branch portions 641 and 643 of the blade arms 640 and 642 extend downwardly from the stem portions 644 and 646 and attach to inferior and superior blades 650 and 652, respectively. The superior blade 652 which is advantageously located below and interconnected to the moveable pivot 624, comprises a recessed throat 654 to capture a rib adjacent to an incision in the patient's chest cavity and a pair of elongated vanes 656 and 657 used to offset a plurality of the patient's ribs. The inferior blade 650 which is interconnected to the fixed pivot 616 comprises a recessed throat 653 used to capture a rib adjacent to an incision in the patient's chest cavity;"</p> <p>page 56, lines 3-13: " The branch portion 643 of the blade arm 642 that is interconnected to the moveable pivot 624 extends higher vertically than the branch portion 641 of the blade arm 640 that is interconnected to the fixed pivot 616 when the blades 650 and 652 are substantially level (see Figure 29). This construction tends to increase the moment about the moveable pivot 624 caused by the offset of the movable pivot from the center-of-effort of the spreading force at the blades 650 and 652. Because the movable pivot 624 is located above the superior blade 652, a lifting force is naturally exerted on the superior blade 652 and ribs as spreading occurs;"</p>
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page 58, line 6-page 59, line 24: "In operation, the blades 650 and 652 are inserted in an incision in the patient's chest such that the elongated vanes 656 and 657 of the blade 652 are positioned under the patient's ribs while the recessed throats 653 and 654 of the blades 650 and 652 are positioned to receive the ribs that are adjacent to the incision. After the blades 650 and 652 are properly positioned, the stem 644 of the blade arm 640 is inserted through the fixed pivot lock 615 into the socket 618 of the fixed pivot 616. Meanwhile, the stem 646 of the blade arm 642 is inserted through the moveable pivot lock 626 and the end of the shoe arm 682 opposite the shoe 680, and into the socket 625 of the moveable pivot 624. The blade 650 is then fixed in position by tightening the fixed pivot lock screw 617 to tighten the fixed pivot lock 615 around the stem 644 of the blade arm 640.

The rib compression shoe 680 is then adjusted downwardly by adjusting the adjustable offset drive screw 636 until the desired compression of the ribs is achieved. The blade 652 that is interconnected to the moveable pivot 624 is then fixed in position relative to the shoe 680 by tightening the moveable pivot lock screw 627 to tighten the moveable pivot lock 626 around the stem 646 of the blade arm 642. The ribs are then separated and simultaneously offset by rotating the lever 622 to drive the pinion 621 along the rack 613 until a desired opening width is realized. Because the movable pivot 624 is advantageously located above the blade 652, the superior blade 652 naturally raises vertically as it rotates about the moveable pivot 624 as a spreading force from the inferior blade 650 is transmitted to the superior blade 652 through the movable pivot 624.

Further adjustment of an offset height of the superior blades 652 may be obtained by first loosening the moveable pivot lock 626 around the stem 646 of the blade arm 642 and then adjusting the adjustable offset drive screw 636 to cause the shoe 680 and the shoe arm 682 to rotate downwardly in a clockwise direction relative to the superior blade 652 and, thus, cause the blade 652 that is interconnected to the moveable pivot 624 to rise vertically until a desired offset is achieved. Alternatively, the blade arm 642 would remain fixed to the shoe arm 682 as the offset drive screw 636 is adjusted to cause the shoe 680 and shoe arm 682 to rotate downwardly in a clockwise direction. The clockwise rotation of the shoe 680 and shoe arm 682 causes the blade 652 to rotate upwardly in a clockwise direction;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 70, line 3-page 71, line 10: "Turning to Figure 40, a seventeenth embodiment of the access platform 800 comprises a spreader housing 801 which includes a drive mechanism housed therein (not shown) and a drive slot 803 cut into the spreader housing 801. A spreader lever 802 is mounted on the top of the spreader housing 801 and is operably connected to the drive mechanism housed therein. An inferior blade 805 having a tissue retractor 804 extending therefrom, is interconnected to the drive mechanism via a blade arm 806. The blade arm 806 extends outwardly from the spreader housing 801 in a generally normal direction.

A pad arm 817 connects at one end, or is formed integrally therewith, to the spreader housing 801 and extends outwardly therefrom. A sternal pad 816 is integrally formed on the pad arm 817 at an end opposite the housing 801. The pad arm 817 is generally arcuate to conform to an extended rib cage due to the offset of the ribs.

A superior blade 820 having a tissue retractor 821 extending therefrom, is connected to the bottom end of a generally arcuately shaped blade arm 818. The top end of the blade arm 818 is pivotally mounted on an offset stanchion 815 that extends upwardly from the pad arm 817. A compression member 813 is pivotally connected to the top of the stanchion 815 at pivot 814 and extends inwardly from the stanchion 815 toward the lever 802 on the spreader housing 801. An offset screw 811 having a handle 812 attached to its top end, is threaded through the compression member 813 at an end opposite the pivot 814 and is rotatably captured by a bushing assembly 808 rotatably coupled to a mount 807 that extends upwardly from the spreader housing 801. A counter-lift tab 809 extends inwardly from the blade arm 818 adjacent the stanchion 815. The lift tab 809 is operably connected to the compression member 813 through an offset spring 810 mounted therebetween;"

page 86, line 9-page 87, line 17: " Referring to Figures 66-70, a self-aligning access platform 260 comprises blades 261 and 262 that are mounted to blade arms 263 and 264, respectively, and include tissue retractors 280 and 281 extending therefrom. The blade arms 263 and 264 are pivotally connected at a pivot 275 and driven apart or together by a drive mechanism 278. The drive mechanism 278 includes a handle 279 operably coupled to a lead screw 277. First and second links 272 and 273 are pivotally coupled to the blade arms 263 and 264, respectively, and a drive block 276 threadably carried on the lead screw 277.

The blade arms 263 and 264 comprise a branch (shown at 265 in Figure 68) that extends upwardly from the blades 261 and 262 to an elbow (shown at 282 in Figure 68) where the blade arms 263 and 264 bend and extend away from the blades 261 and 262. The blade arms 263 and 264 narrow down to a thin section at flexures 289 and 290 adjacent the blade arm elbows. Thin elongated tension members 266 and 267 extend between the drive member 278 and the blade arm elbows in a spaced relation with the blade arms 263 and 264. The tension members 266 and 267 include knuckles 268 and 269 coupled to the blade arms 263 and 264 at pivots 270 and 274. Thin flexures 288 and 291 are formed at the intersection between the tension members 266 and 267 and the blade arm elbows. As the drive member is operated to spread the ribs apart, the blades 261 and 262 will advantageously flex about flexures 288 and 289 and 290 and 291, respectively, to compensate for the alignment of the blade arms 263 and 264 relative to the retracted ribs.

Alternatively, blades 261 and 262 are coupled to the blade arms 263 and 264 which have V-shaped mounts 286 and 287 with opposing flexures 288 and 289, 290 and 291, respectively. As the ribs are separated, the blades 261 and 262 will flex at flexures 288, 289, 290 and 291 and, thus, advantageously apply a force at the center of effort through the flexures 288, 289, 290 and 291;"

103. The retractor according to claim 102 including mounting means mounting said self-adjusting lifter blade so that said self-adjusting lifter blade swings freely on said movable retractor arm.

See, e.g., page 54, line 16-page 55, line 19: "Referring to Figures 31 and 32, a fourteenth embodiment of the access platform 610 of the present invention comprises a spreader component 612 that includes a rack 613, a spreader base 614 attached to one end of the rack 613 and a pinion housing 620 slidably received over the rack 613. A pinion 621 that is driven by a lever 622 is rotatably retained in the pinion housing 620 and operably connected to the rack 613.

A fixed pivot 616 having a socket 618 formed therein, extends from the spreader base 614. A fixed pivot lock 615 with a lock screw 617 is fixedly connected to the fixed pivot 616. A moveable pivot 624 having a socket 625 formed therein, extends from the housing 620. Rotatably and releasably received in and extending from the sockets 618 and 625 are stem portions 644 and 646 of a pair of blade arms 640 and 642, respectively. The stem 644 that is received in the socket 618 of the fixed pivot 616 includes a stop 645 formed on its exterior to abut the fixed pivot lock 615 and stop the travel of the stem 644. Branch portions 641 and 643 of the blade arms 640 and 642 extend downwardly from the stem portions 644 and 646 and attach to inferior and superior blades 650 and 652, respectively. The superior blade 652 which is advantageously located below and interconnected to the moveable pivot 624, comprises a recessed throat 654 to capture a rib adjacent to an incision in the patient's chest cavity and a pair of elongated vanes 656 and 657 used to offset a plurality of the patient's ribs. The inferior blade 650 which is interconnected to the fixed pivot 616 comprises a recessed throat 653 used to capture a rib adjacent to an incision in the patient's chest cavity;"

page 56, lines 3-13: " The branch portion 643 of the blade arm 642 that is interconnected to the moveable pivot 624 extends higher vertically than the branch portion 641 of the blade arm 640 that is interconnected to the fixed pivot 616 when the blades 650 and 652 are substantially level (see Figure 29). This construction tends to increase the moment about the moveable pivot 624 caused by the offset of the movable pivot from the center-of-effort of the spreading force at the blades 650 and 652. Because the movable pivot 624 is located above the superior blade 652, a lifting force is naturally exerted on the superior blade 652 and ribs as spreading occurs;"

page 58, line 6-page 59, line 24: "In operation, the blades 650 and 652 are inserted in an incision in the patient's chest such that the elongated vanes 656 and 657 of the blade 652 are positioned under the patient's ribs while the recessed throats 653 and 654 of the blades 650 and 652 are positioned to receive the ribs that are adjacent to the incision. After the blades 650 and 652 are properly positioned, the stem 644 of the blade arm 640 is inserted through the fixed pivot lock 615 into the socket 618 of the fixed pivot 616. Meanwhile, the stem 646 of the blade arm 642 is inserted through the moveable pivot lock 626 and the end of the shoe arm 682 opposite the shoe 680, and into the socket 625 of the moveable pivot 624. The blade 650 is then fixed in position by tightening the fixed pivot lock screw 617 to tighten the fixed pivot lock 615 around the stem 644 of the blade arm 640.

The rib compression shoe 680 is then adjusted downwardly by adjusting the adjustable offset drive screw 636 until the desired compression of the ribs is achieved. The blade 652 that is interconnected to the moveable pivot 624 is then fixed in position relative to the shoe 680 by tightening the moveable pivot lock screw 627 to tighten the moveable pivot lock 626 around the stem 646 of the blade arm 642. The ribs are then separated and simultaneously offset by rotating the lever 622 to drive the pinion 621 along the rack 613 until a desired opening width is realized. Because the movable pivot 624 is advantageously located above the blade 652, the superior blade 652 naturally raises vertically as it rotates about the moveable pivot 624 as a spreading force from the inferior blade 650 is transmitted to the superior blade 652 through the movable pivot 624.

Further adjustment of an offset height of the superior blades 652 may be obtained by first loosening the moveable pivot lock 626 around the stem 646 of the blade arm 642 and then adjusting the adjustable offset drive screw 636 to cause the shoe 680 and the shoe arm 682 to rotate downwardly in a clockwise direction relative to the superior blade 652 and, thus, cause the blade 652 that is interconnected to the moveable pivot 624 to rise vertically until a desired offset is achieved. Alternatively, the blade arm 642 would remain fixed to the shoe arm 682 as the offset drive screw 636 is adjusted to cause the shoe 680 and shoe arm 682 to rotate downwardly in a clockwise direction. The clockwise rotation of the shoe 680 and shoe arm 682 causes the blade 652 to rotate upwardly in a clockwise direction;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 70, line 3-page 71, line 10: "Turning to Figure 40, a seventeenth embodiment of the access platform 800 comprises a spreader housing 801 which includes a drive mechanism housed therein (not shown) and a drive slot 803 cut into the spreader housing 801. A spreader lever 802 is mounted on the top of the spreader housing 801 and is operably connected to the drive mechanism housed therein. An inferior blade 805 having a tissue retractor 804 extending therefrom, is interconnected to the drive mechanism via a blade arm 806. The blade arm 806 extends outwardly from the spreader housing 801 in a generally normal direction.

A pad arm 817 connects at one end, or is formed integrally therewith, to the spreader housing 801 and extends outwardly therefrom. A sternal pad 816 is integrally formed on the pad arm 817 at an end opposite the housing 801. The pad arm 817 is generally arcuate to conform to an extended rib cage due to the offset of the ribs.

A superior blade 820 having a tissue retractor 821 extending therefrom, is connected to the bottom end of a generally arcuately shaped blade arm 818. The top end of the blade arm 818 is pivotally mounted on an offset stanchion 815 that extends upwardly from the pad arm 817. A compression member 813 is pivotally connected to the top of the stanchion 815 at pivot 814 and extends inwardly from the stanchion 815 toward the lever 802 on the spreader housing 801. An offset screw 811 having a handle 812 attached to its top end, is threaded through the compression member 813 at an end opposite the pivot 814 and is rotatably captured by a bushing assembly 808 rotatably coupled to a mount 807 that extends upwardly from the spreader housing 801. A counter-lift tab 809 extends inwardly from the blade arm 818 adjacent the stanchion 815. The lift tab 809 is operably connected to the compression member 813 through an offset spring 810 mounted therebetween;"

106. An intermammary artery access retractor comprising:

See, e.g., figures 1-2, 13-23, 26, 28-34, 39, 40, and 66-70;

page 1, lines 15-17: "This invention relates to retractors, and more particularly to an access platform that facilitates access to the interior of the chest cavity during surgical procedures;"

page 8, lines 14-16: "The access platform of the present invention serves to facilitate the dissection of an internal mammary artery (IMA), including both proximal and distal dissection;"

page 18, lines 12-17: "Referring now in detail to the drawings, therein illustrated are novel embodiments of an access platform that facilitates the dissection of an internal mammary artery (IMA), including both proximal and distal dissection, and access to the heart during a "beating heart" Coronary Artery Bypass Graph (CABG) procedure by increasing the surgeon's working space and visual access;"

page 18, line 23-page 19, line 3: "Turning to Figure 1, the access platform 10 incorporating a preferred embodiment of the present invention, is shown disposed over the outline of a patient's chest P. An incision in the patient's chest P adjacent to the LIMA (shown in phantom) exposes an LAD artery on the exterior of the patient's heart."

<p>a spreader member having a first blade arm and a second blade arm, said second blade arm being movable toward or away from said first blade arm;</p>	<p>See, e.g., page 9, lines 2-10: " The access platform of the present invention is preferably capable of laterally spreading the ribs, vertically displacing the opposingly retracted ribs relative to each other and depressing the sternum to cause a "tunnel" effect under the retracted ribs. Moreover, it is preferably self-contained such that the force necessary to spread and vertically displace the ribs is applied by the access platform itself rather than through additional external devices. The access platform preferably comprises first and second blades interconnected to a spreader member that laterally drives the blades apart or together, a sternal pad interconnected to the blades, and a vertical displacement member interconnected to a blade and the spreader member. The vertical displacement member may preferably be bi-directional to cause the interconnected blade to be vertically displaced in either direction and, thus, increases the surgeon's working space and visual access to the IMA.;"</p>
	<p>page 19, lines 4-23: "Preferably, the access platform 10 comprises a pair of blades 50 and 51, a pair of support pads 80 and 81, a pair of tissue retractors 70 and 71, a pair of torsional members 30 and 31, and a spreader member 12. The torsional members 30 and 31 and the spreader member 12 preferably extend away from the blades 50 and 51 and the tissue retractors 70 and 71 and, thus, the chest incision, in a plane relatively parallel to the patient's chest. As a result, the access platform 10 advantageously maintains a low profile that remains substantially clear of the surgeon's working space.</p> <p>Referring to Figure 2, the components of the access platform 10 are shown less the tissue retractors 70 and 71. The spreader member 12 preferably comprises a rotatable hub 14 including operably coupled upper and lower hub halves 17 and 16. A pair of spreader arms 19 and 18 extend from the upper and lower hub halves 17 and 16, respectively, and connect to the torsional members 31 and 30, respectively. Preferably, the hub 14 includes a harmonic gear drive 20 used to rotate the upper hub half 17 relative to the lower hub half 16 and, thus, spread or close the spreader arms 18 and 19 to retract or relax the patient's ribs;"</p>
	<p>page 21, line 13-page 22, line 2: "Blade arms 56 and 57 interconnect the blades 50 and 51 to the rest of the access platform 10. The blade arms 56 and 57 comprise stems 62 and 63 received in sockets 34 and 35 in torque bases 32 and 33. The sockets 34 and 35 and the stems 62 and 63 are constructed such that the blade arms 56 and 57 are releasably connected to the torque bases 32 and 33. The stems 62 and 63, which extend relatively horizontally from the torque bases 32 and 33, include pivot sections 60 and 61 extending therefrom. Branches 58 and 59 extend outwardly and downwardly away from the pivot sections 60 and 61 and are attached to the throats 54 and 55 of the blades 50 and 51. This blade arm construction advantageously directs the bulk of the access platform 10 away from the surgeon's working area;"</p>
	<p>page 32, lines 14-20: " A second embodiment of the access platform 110 is shown in Figures 13, 14 and 15. The second embodiment of the access platform 110 includes a spreader member 112 preferably comprising a horizontally disposed rack 120 and pinion housings 121 and 122 slidably disposed over the rack 120. The pinion housings 121 and 122 rotatably retain pinions 123 and 124 driven by levers 125 and 126;"</p>

page 33, lines 6-14: " The blade arms 146 and 147 further comprise pivot sections 150 and 151 extending horizontally from the stems 152 and 153. Branches 148 and 149 extend downwardly and outwardly from the pivot sections 150 and 151 of the blade arms 146 and 147 to position the remainder of the access platform 110 away from the surgeon's working area. Branches 148 and 149 attach to blades 140 and 141. The blades 140 and 141 comprise elongated vane sections 142 and 143 extending outwardly from recessed throat sections 144 and 145;"

page 36, line 22-page 37, line 11: " A third embodiment of the access platform 210 is shown in Figures 16 and 17. The third embodiment of the access platform 210 includes a spreader member 212 comprising a horizontally-disposed rack 214 and pinion housings 216 and 218 slidably disposed over the rack 214. Pinions 220 and 222 are rotatably retained in the pinion housings 216 and 218 and driven by levers 224 and 226.

Blades 230 and 231 comprise elongated vane sections 232 and 233 extending from recessed throat sections 234 and 235. Blade arms 236 and 237 have branches 238 and 239 that extend downwardly and outwardly from horizontally disposed stems 240 and 241 and connect to the blades 230 and 231. The stems 240 and 241 of the blade arms 236 and 237 are releasably received in sockets 217 and 219 formed in the pinion housings 216 and 218;"

page 38, line 15-page 39, line 18: "A fourth embodiment is shown in Figure 18. The access platform 310 of the fourth embodiment includes a spreader member 312 comprising a rack 320, a housing 322 slidably received over the rack 320, a pinion 324 rotatably retained in the housing 322 and a lever 326 connected to the pinion 324. A spreader base 328 is attached to one end of the rack 320. A pair of parallel spaced fingers 330A and 330B extend from the housing 322. Similarly, a pair of parallel spaced fingers 332A and 332B extend from the spreader base 328 and are positioned parallel to the fingers 330A and 330B extending from the housing 322.

A pair of blade arms 338 and 340 include branch sections 346 and 348 that extend downwardly from central portions 339 and 341 and connect to blades 350 and 352. Stem portions 342 and 344 extend from the central portions 339 and 341 opposite the branch sections 346 and 348. The stem 342 extends between and is pivotally mounted to fingers 330A and 330B at a pivot 331. Likewise, stem 344 extends between and is pivotally mounted to fingers 332A and 332B at a pivot 333. As a result, the blade arms 338 and 340 rotate about an axis of rotation A_1 that is parallel to the rack 320. This construction advantageously enables the access platform 310 to address a thoracotomy positioned anywhere along the chest wall without intruding on the surgeon's working space. If the thoracotomy is located on the lateral side of the chest wall the spreader member 312, the spreader base 328 and the housing 322 are simply pivoted away from the surgeon's working space;"

page 39, line 22-page 40, line 17: "a fifth embodiment of the access platform 310 modifies the fourth embodiment shown in Figure 18 to include a pair of links 360 and 362 interposed and hingedly interconnected to the blade arms 338 and 340 and the housing 322 and spreader base 328, respectively. The links 360 and 362 comprise link bodies 364 and 366 and parallel spaced fingers 368A and 368B and 369A and 369B, respectively, extending from the link bodies 364 and 366. The link bodies 364 and 366 extend between and pivotally mount to the fingers 330A and 330B and 332A and 332B at pivots 331 and 333, respectively. Likewise, the stems 342 and 344 of the blade arms 338 and 340 extend between and pivotally mount to the fingers 368A and 368B and 369A and 369B at pivots 363 and 365, respectively. As a result, the blade arms 338 and 340 and the links 360 and 362 rotate about parallel axes of rotation A_1 and A_2 that are parallel to the rack 320. This construction further enables the access platform 310 to address a thoracotomy positioned anywhere along the chest wall without intruding on the surgeon's working space by easily pivoting the spreader base 328, the housing 332 and the rack 320 out of the surgeon's way;"

page 42, lines 3-19: "A sixth embodiment of the access platform 310 is shown in Figure 22 to comprise a combination of components from the first and fourth embodiments (Figures 2 and 18). More particularly, the torsional members 30 and 31 of the first embodiment are interposed between and operably connected to the fingers 330A and 330B and the housing 322, and interposed between and operably connected to the fingers 332A and 332B and the spreader base 328, respectively. In addition, the support pads 80 and 81 of the first embodiment are adjustably attached to the fingers 330A and 330B, 332A and 332B. By including the torsional members 30 and 31 and the support pads 80 and 81, second and third axes of rotation A_2 and A_3 are provided. Thus, as in the first embodiment, the torsional members 30 and 31 enable the access platform 310 to vertically displace the blades 350 and 352 and the retracted ribs. To vertically displace the blades 350 and 352, the blade arms 338 and 340 are fixedly coupled to the fingers 330A and 330B, 332A and 332B by pins 334 and 336;"

page 42, line 20-page 43, line 21: "Turning to Figure 23, a seventh embodiment of the access platform is shown to comprise a modification of the fifth embodiment of the access platform shown in Figure 19. The access platform 310 in Figure 23 includes an offset assembly 308 interconnected to the blades 350 and 352. The offset assembly 308 comprises lead screws 313 and 314 extending between the blades 350 and 352 and further operably interconnecting the blades 350 and 352. At a first end, the lead screws 313 and 314 are rotatably captured by capture mounts 317 and 318. The capture mounts 317 and 318 are fixed to the blade 350. The threaded portion of the lead screws 313 and 314 threadably passes through a pair of lift mounts 315 and 316. The lift mount 315 is affixed to the blade arm 340 which is interconnected to the superior blade 352. The lift mount 316 is affixed to the top of a lift mount arm 319 extending vertically from the superior blade 352 to a height which is level with the lift mount 315 on the blade arm 340. Levers 309 and 311, which are attached to a second end of the lead screws 313 and 314, are used to rotate the lead screws 313 and 314 to drive the lift mounts 315 and 316 thereon. With the horizontal distance between the inferior and superior blades 350 and 352 adjustably fixed by the spreader member 312, the offset assembly 308 is only able to vertically displace the blade 352 relative to the blade 350. Thus, depending on the direction of rotation of the lead screws 313 and 314, the superior blade 352 will be raised or lowered to offset it relative to the inferior blade 350;"

page 45, line 3-page 46, line 5: "Turning to Figure 26, a ninth embodiment of the access platform 410 of the present invention is shown. The access platform 410 mounts to the table or rail via slides 438 and 440 that are locked in place by positioners 450 and 452. The slides 438 and 440 rotatably retain pinions 442 and 444 driven by levers 446 and 448 and slidably receive stanchion racks 430 and 432. The stanchion racks 430 and 432 include rack gears 434 and 436 that operably couple with pinions 442 and 444. The levers 446 and 448 are rotated to drive the pinions 442 and 444 along rack gears 434 and 436 to adjust the height of the stanchion racks 430 and 432 relative to the table or patient, or to vertically offset blades 470 and 472 relative to one another.

A pinion housing 422 is slidably attached to the stanchion rack 432 towards its upper end. A rack 420 is attached at one end to stanchion rack 430 and is slidably received in the pinion housing 422. A pinion 424 driven by a lever 426 is rotatably retained in the pinion housing 422 and operably connected to the rack 420. The lever 426 is rotated to drive the pinion 424 along the rack 420 to spread apart the stanchion racks 430 and 432 and effectively a patient's ribs.

Torsional members 460 and 462 are attached to the top of the stanchion racks 430 and 432. Blade arms 474 and 476 extend outwardly from torsional members and attach to the blades 470 and 472. The torsional members comprise inner hubs 461 and 465 rotatably received in and operably connected to outer hubs 463 and 467. Locking levers 464 and 466 lock the inner hubs 461 and 465 in place relative to the outer hubs 463 and 467.

In operation, the access platform 410 is positioned such that the blades 470 and 472 can be inserted into an incision in a patient's chest and then attached to the blade arms 474 and 476. Once the blades 470 and 472 are positioned in the incision and attached to the blade arms 474 and 476, the lever 426 is rotated to spread the blades 470 and 472 and the patient's ribs apart. The blades 470 and 472 can be effectively offset by rotating the inner hubs 461 and 465 relative to the outer hubs 463 and 467. While the blades 470 and 472 are rotated, the stanchion racks 430 and 432 can be raised or lowered by rotating levers 486 and 488 to drive pinions 442 and 444. By raising or lowering the stanchion racks 430 and 432, the blades 470 and 472 can be effectively raised or lowered relative to one another to further offset the blades 470 and 472 relative to one another. A wrench 468 is utilized to rotate the inner hubs 461 and 465 relative to the outer hubs 463 and 467;"

page 48, lines 1-11: "Turning to Figure 28, an eleventh embodiment of the access platform 651 comprises a spreader housing 602 that includes a drive mechanism therein (not shown) and a drive slot 608 formed therein. A spreader lever 604 is mounted on top of the spreader housing 602 and is operably connected to the drive mechanism housed therein. An inferior blade 650 is interconnected to the drive mechanism via a blade arm 640 which extends outwardly to the inferior blade 650 from the spreader housing 602 in a direction generally normal to the housing 602. A tissue retractor 670 is attached to the blade 650 to assist in tissue retraction;"

page 50, line 17-page 51, line 9: "Referring to Figure 29, a twelfth embodiment of an access platform 659 is shown to comprise a modification of the eleventh embodiment of the access platform 651 shown in Figure 28. The offset assembly 690 of the access platform includes an offset housing 691 extending upwardly from the spreader housing 602 and adapted to slidably receive a curved rack 692. The blade arm 642 is attached to the curved rack 692 through a slot 699 in the housing 691. A worm gear 693 is positioned within the housing 691 and is operably connected to the curved rack 692. A worm gear shaft 689 extends from the worm gear 693 and connects to a lever 694 outside of the housing 691. Thus, to lift the superior blade 652 and ribs, the lever 694 is rotated in an appropriate direction to rotate the worm gear 693 to drive the curved rack 692 upwardly and outwardly from the housing 691. To lower the superior blade 652 from the offset position, the lever 694 is reverse rotated to drive the curved rack 692 in an opposite direction;"

page 51, line 10-page 52, line 20: " Turning to Figure 30, a thirteenth embodiment of the access platform 655 of the present invention comprises a generally elongated drive base 601 having a blade arm 640 and a pad arm 683 extending therefrom. The blade arm 640 extends in a generally normal direction from the drive base 601, while the pad arm 683, which is generally arcuately shaped, extends longitudinally and downwardly from the drive base 601. The pad arm 683 terminates in a sternal pad 681. A threaded shaft carrier 607 extends upwardly from the drive base 601 adjacent the blade arm 640. An inferior blade 650 having a tissue retractor 670 extending therefrom attaches to the blade arm 640. In a preferred construction, the inferior blade 650, tissue retractor 670, blade arm 640, threaded shaft carrier 607, drive base 601, pad arm 683, and sternal pad 681 are formed from one-piece construction.

A hollow threaded shaft 603 is threaded through the shaft carrier 607 and extends along the drive base 601 to rotatably attach to a hollow drive block 609. A spreader handle 605 is attached to the shaft 603 at an end opposite the drive block 609. A worm gear 697 positioned in the drive block 609, is fixed to the end of a shaft 696 that passes through the hollow threaded shaft 603 and attaches to an offset handle 695 beyond the spreader handle 605. The worm gear 697 is operably connected to an arcuate worm gear rack 698 that is positioned within the drive block 609 and connected to a branch 643 of a blade arm 642. The branch 643 of the blade arm 642 extends from the blade arm 642 in a normal direction and is pivotally mounted to the hollow drive block 609. The blade arm 642 extends downwardly from the branch 643 and attaches to a superior blade 652 with a tissue retractor 672 extending therefrom. A follower 619 extends downwardly from the base of the hollow drive block 609 and is received in a elongated drive slot 611 in the drive base 601. As the drive block 609 is transversely driven along the base 601 by the threaded shaft 603, the follower 609 slidably follows the drive slot 611 in the drive base 601;"

page 54, line 16-page 55, line 19: "Referring to Figures 31 and 32, a fourteenth embodiment of the access platform 610 of the present invention comprises a spreader component 612 that includes a rack 613, a spreader base 614 attached to one end of the rack 613 and a pinion housing 620 slidably received over the rack 613. A pinion 621 that is driven by a lever 622 is rotatably retained in the pinion housing 620 and operably connected to the rack 613.

A fixed pivot 616 having a socket 618 formed therein, extends from the spreader base 614. A fixed pivot lock 615 with a lock screw 617 is fixedly connected to the fixed pivot 616. A moveable pivot 624 having a socket 625 formed therein, extends from the housing 620. Rotatably and releasably received in and extending from the sockets 618 and 625 are stem portions 644 and 646 of a pair of blade arms 640 and 642, respectively. The stem 644 that is received in the socket 618 of the fixed pivot 616 includes a stop 645 formed on its exterior to abut the fixed pivot lock 615 and stop the travel of the stem 644. Branch portions 641 and 643 of the blade arms 640 and 642 extend downwardly from the stem portions 644 and 646 and attach to inferior and superior blades 650 and 652, respectively. The superior blade 652 which is advantageously located below and interconnected to the moveable pivot 624, comprises a recessed throat 654 to capture a rib adjacent to an incision in the patient's chest cavity and a pair of elongated vanes 656 and 657 used to offset a plurality of the patient's ribs. The inferior blade 650 which is interconnected to the fixed pivot 616 comprises a recessed throat 653 used to capture a rib adjacent to an incision in the patient's chest cavity;"

page 56, lines 3-13: " The branch portion 643 of the blade arm 642 that is interconnected to the moveable pivot 624 extends higher vertically than the branch portion 641 of the blade arm 640 that is interconnected to the fixed pivot 616 when the blades 650 and 652 are substantially level (see Figure 29). This construction tends to increase the moment about the moveable pivot 624 caused by the offset of the movable pivot from the center-of-effort of the spreading force at the blades 650 and 652. Because the movable pivot 624 is located above the superior blade 652, a lifting force is naturally exerted on the superior blade 652 and ribs as spreading occurs;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 64, line 5-page 67, line 5: " Referring to Figure 39, a sixteenth embodiment of an access platform 780 comprises a generally elongated drive base 781 having a blade arm 782 extended generally in a normal direction from the drive base 781. A generally arcuate pad arm 786 extends generally longitudinally and downwardly from the drive base 781 and terminates at a sternal pad 785. A bearing support 791 extends upwardly from the drive base 781 adjacent the blade arm 782. An inferior blade 783 having a tissue retractor 784 extending therefrom attaches to the end of the inferior blade arm 782. In a preferred construction, the inferior blade 781, tissue retractor 784, blade arm 782, bearing support 791, drive base 781, pad arm 786 and sternal pad 785 are formed from one-piece construction.

A bearing 792 is mounted to the bearing support 791 and has a spreader handle 793 operably coupled thereto. A drive screw 787 having an offset handle 794 with a lever 795 attached to its first end, is threaded through the spreader handle 793 and freely passes through the bearing 792 and bearing support 791. The drive screw 787 extends longitudinally along the drive base 781 and is threaded through a carrier mount 789. The spreader handle 793 and the carrier mount 789 include oppositely wound threads. Rotation of the spreader handle 793 transversely drives the drive screw 787 and the carrier mount 789 mounted thereon along the drive base 781 and, thus, spreads or closes the blades 783 and 796. The carrier mount 789 includes a follower extending downwardly from its base that inserts into a drive slot 788 in the base 781. As the carrier mount 789 is translated across the drive base 781, the follower slides along the drive slot 788.

Extending upwardly and longitudinally outwardly in a direction away from the spreader handle 793, a carrier arm 790 extends from the carrier 789. At an end opposite the carrier mount 789, the carrier arm 790 pivotally captures at a pivot 799 a branch 797A of a blade arm 797. A tab 779 is fixed to the branch 797A adjacent the pivot 799 and extends downwardly in a direction normal to the branch 797A. The tab 779 contacts a shaft-end 787A of the drive shaft 787 opposite the offset handle 794 and extending beyond the carrier 789. The branch 797A extends outwardly from the pivot 799 in a normal direction to the carrier arm 790 and couples to the blade arm 797 at an end opposite the carrier arm 790. The blade arm 797 is generally arcuately shaped and extends downwardly from the branch 797A to connect to a superior blade 796 with a tissue retractor 798 extending therefrom. Because the pivot 799 is located above the superior blade 796, a lifting force is exerted on the superior blade 796 and ribs as a spreading force from the inferior blade 783 is transmitted to the superior blade 796 through the pivot 799.

Rotation of the offset handle 794, while holding the spreader handle 793 stationary, will thread the drive screw 787 through both the spreader handle 793 and the carrier 789, and thereby cause the drive screw 787 and carrier 789 to traverse the drive base 781 as well as causing the carrier 789 to traverse the drive screw 787 in the same direction. As a result, the carrier 789 traverses the drive base 781 at approximately two-times the speed that the carrier 789 traverses the drive screw 787 and thus, the length of the shaft-end 787A extending beyond the carrier 789 will increase or decrease at approximately one-half the speed at which the carrier 789 traverses the drive base 781. Therefore, as the offset handle 794 is rotated in a direction to spread the ribs, the ribs will be raised at a rate slower than they are spread as the superior blade 796 naturally rotates about the pivot 799 as the length of the shaft-end 787A extending beyond the carrier 789 decreases. Similarly, as the offset handle 794 is rotated in a direction to lower the offset ribs, the length of the shaft-end 787A will increase, at a rate slower than the rate at which the carrier 789 traverses the drive base 781. As the length of the shaft end 787A increases, it forces the tab 779, and thus the superior blade 797, to rotate in the counterclockwise direction around the pivot 799, and thereby further lowers the ribs. Because the carrier 789 traverses the drive base 781 at a faster rate than the shaft-end 787A increases, the distance between the blades 783 and 796 along the drive base 781 tends to decrease as the ribs are lowered;"

page 70, line 3-page 71, line 10: "Turning to Figure 40, a seventeenth embodiment of the access platform 800 comprises a spreader housing 801 which includes a drive mechanism housed therein (not shown) and a drive slot 803 cut into the spreader housing 801. A spreader lever 802 is mounted on the top of the spreader housing 801 and is operably connected to the drive mechanism housed therein. An inferior blade 805 having a tissue retractor 804 extending therefrom, is interconnected to the drive mechanism via a blade arm 806. The blade arm 806 extends outwardly from the spreader housing 801 in a generally normal direction.

A pad arm 817 connects at one end, or is formed integrally therewith, to the spreader housing 801 and extends outwardly therefrom. A sternal pad 816 is integrally formed on the pad arm 817 at an end opposite the housing 801. The pad arm 817 is generally arcuate to conform to an extended rib cage due to the offset of the ribs.

A superior blade 820 having a tissue retractor 821 extending therefrom, is connected to the bottom end of a generally arcuately shaped blade arm 818. The top end of the blade arm 818 is pivotally mounted on an offset stanchion 815 that extends upwardly from the pad arm 817. A compression member 813 is pivotally connected to the top of the stanchion 815 at pivot 814 and extends inwardly from the stanchion 815 toward the lever 802 on the spreader housing 801. An offset screw 811 having a handle 812 attached to its top end, is threaded through the compression member 813 at an end opposite the pivot 814 and is rotatably captured by a bushing assembly 808 rotatably coupled to a mount 807 that extends upwardly from the spreader housing 801. A counter-lift tab 809 extends inwardly from the blade arm 818 adjacent the stanchion 815. The lift tab 809 is operably connected to the compression member 813 through an offset spring 810 mounted therebetween;"

<p>a first blade mounted on said first blade arm;</p>	<p>See, e.g., page 9, lines 2-10: "The access platform of the present invention is preferably capable of laterally spreading the ribs, vertically displacing the opposingly retracted ribs relative to each other and depressing the sternum to cause a "tunnel" effect under the retracted ribs. Moreover, it is preferably self-contained such that the force necessary to spread and vertically displace the ribs is applied by the access platform itself rather than through additional external devices. The access platform preferably comprises first and second blades interconnected to a spreader member that laterally drives the blades apart or together, a sternal pad interconnected to the blades, and a vertical displacement member interconnected to a blade and the spreader member. The vertical displacement member may preferably be bi-directional to cause the interconnected blade to be vertically displaced in either direction and, thus, increases the surgeon's working space and visual access to the IMA;"</p>
	<p>page 19, lines 4-7: " Preferably, the access platform 10 comprises a pair of blades 50 and 51, a pair of support pads 80 and 81, a pair of tissue retractors 70 and 71, a pair of torsional members 30 and 31, and a spreader member 12;"</p>
	<p>page 21, lines 6-12: " Referring to Figure 2, the blades 50 and 51 preferably include elongated vanes 52 and 53, which slide beneath a plurality of the patient's ribs, and recessed arcuate throats 54 and 55 that receive the patient's ribs that are adjacent to the chest incision. The benefits of the recessed throats 54 and 55 and the elongated vanes 52 and 53 will be discussed below with regard to the operation of the access platform 10;"</p>
	<p>page 33, lines 6-14: " The blade arms 146 and 147 further comprise pivot sections 150 and 151 extending horizontally from the stems 152 and 153. Branches 148 and 149 extend downwardly and outwardly from the pivot sections 150 and 151 of the blade arms 146 and 147 to position the remainder of the access platform 110 away from the surgeon's working area. Branches 148 and 149 attach to blades 140 and 141. The blades 140 and 141 comprise elongated vane sections 142 and 143 extending outwardly from recessed throat sections 144 and 145;"</p>
	<p>page 39, lines 3-5: " A pair of blade arms 338 and 340 include branch sections 346 and 348 that extend downwardly from central portions 339 and 341 and connect to blades 350 and 352;"</p>
	<p>page 42, lines 3-19: "A sixth embodiment of the access platform 310 is shown in Figure 22 to comprise a combination of components from the first and fourth embodiments (Figures 2 and 18). More particularly, the torsional members 30 and 31 of the first embodiment are interposed between and operably connected to the fingers 330A and 330B and the housing 322, and interposed between and operably connected to the fingers 332A and 332B and the spreader base 328, respectively. In addition, the support pads 80 and 81 of the first embodiment are adjustably attached to the fingers 330A and 330B, 332A and 332B. By including the torsional members 30 and 31 and the support pads 80 and 81, second and third axes of rotation A_2 and A_3 are provided. Thus, as in the first embodiment, the torsional members 30 and 31 enable the access platform 310 to vertically displace the blades 350 and 352 and the retracted ribs. To vertically displace the blades 350 and 352, the blade arms 338 and 340 are fixedly coupled to the fingers 330A and 330B, 332A and 332B by pins 334 and 336.;"</p>

page 42, lines 20-page 43, line 21: "Turning to Figure 23, a seventh embodiment of the access platform is shown to comprise a modification of the fifth embodiment of the access platform shown in Figure 19. The access platform 310 in Figure 23 includes an offset assembly 308 interconnected to the blades 350 and 352. The offset assembly 308 comprises lead screws 313 and 314 extending between the blades 350 and 352 and further operably interconnecting the blades 350 and 352. At a first end, the lead screws 313 and 314 are rotatably captured by capture mounts 317 and 318. The capture mounts 317 and 318 are fixed to the blade 350. The threaded portion of the lead screws 313 and 314 threadably passes through a pair of lift mounts 315 and 316. The lift mount 315 is affixed to the blade arm 340 which is interconnected to the superior blade 352. The lift mount 316 is affixed to the top of a lift mount arm 319 extending vertically from the superior blade 352 to a height which is level with the lift mount 315 on the blade arm 340. Levers 309 and 311, which are attached to a second end of the lead screws 313 and 314, are used to rotate the lead screws 313 and 314 to drive the lift mounts 315 and 316 thereon. With the horizontal distance between the inferior and superior blades 350 and 352 adjustably fixed by the spreader member 312, the offset assembly 308 is only able to vertically displace the blade 352 relative to the blade 350. Thus, depending on the direction of rotation of the lead screws 313 and 314, the superior blade 352 will be raised or lowered to offset it relative to the inferior blade 350;"

page 45, line 3-page 46, line 5: "Turning to Figure 26, a ninth embodiment of the access platform 410 of the present invention is shown. The access platform 410 mounts to the table or rail via slides 438 and 440 that are locked in place by positioners 450 and 452. The slides 438 and 440 rotatably retain pinions 442 and 444 driven by levers 446 and 448 and slidably receive stanchion racks 430 and 432. The stanchion racks 430 and 432 include rack gears 434 and 436 that operably couple with pinions 442 and 444. The levers 446 and 448 are rotated to drive the pinions 442 and 444 along rack gears 434 and 436 to adjust the height of the stanchion racks 430 and 432 relative to the table or patient, or to vertically offset blades 470 and 472 relative to one another.

A pinion housing 422 is slidably attached to the stanchion rack 432 towards its upper end. A rack 420 is attached at one end to stanchion rack 430 and is slidably received in the pinion housing 422. A pinion 424 driven by a lever 426 is rotatably retained in the pinion housing 422 and operably connected to the rack 420. The lever 426 is rotated to drive the pinion 424 along the rack 420 to spread apart the stanchion racks 430 and 432 and effectively a patient's ribs.

Torsional members 460 and 462 are attached to the top of the stanchion racks 430 and 432. Blade arms 474 and 476 extend outwardly from torsional members and attach to the blades 470 and 472. The torsional members comprise inner hubs 461 and 465 rotatably received in and operably connected to outer hubs 463 and 467. Locking levers 464 and 466 lock the inner hubs 461 and 465 in place relative to the outer hubs 463 and 467;"

page 48, lines 1-11: "Turning to Figure 28, an eleventh embodiment of the access platform 651 comprises a spreader housing 602 that includes a drive mechanism therein (not shown) and a drive slot 608 formed therein. A spreader lever 604 is mounted on top of the spreader housing 602 and is operably connected to the drive mechanism housed therein. An inferior blade 650 is interconnected to the drive mechanism via a blade arm 640 which extends outwardly to the inferior blade 650 from the spreader housing 602 in a direction generally normal to the housing 602. A tissue retractor 670 is attached to the blade 650 to assist in tissue retraction;"

page 50, line 17-page 51, line 9: "Referring to Figure 29, a twelfth embodiment of an access platform 659 is shown to comprise a modification of the eleventh embodiment of the access platform 651 shown in Figure 28. The offset assembly 690 of the access platform includes an offset housing 691 extending upwardly from the spreader housing 602 and adapted to slidably receive a curved rack 692. The blade arm 642 is attached to the curved rack 692 through a slot 699 in the housing 691. A worm gear 693 is positioned within the housing 691 and is operably connected to the curved rack 692. A worm gear shaft 689 extends from the worm gear 693 and connects to a lever 694 outside of the housing 691. Thus, to lift the superior blade 652 and ribs, the lever 694 is rotated in an appropriate direction to rotate the worm gear 693 to drive the curved rack 692 upwardly and outwardly from the housing 691. To lower the superior blade 652 from the offset position, the lever 694 is reverse rotated to drive the curved rack 692 in an opposite direction;"

page 51, line 10-page 52, line 20: " Turning to Figure 30, a thirteenth embodiment of the access platform 655 of the present invention comprises a generally elongated drive base 601 having a blade arm 640 and a pad arm 683 extending therefrom. The blade arm 640 extends in a generally normal direction from the drive base 601, while the pad arm 683, which is generally arcuately shaped, extends longitudinally and downwardly from the drive base 601. The pad arm 683 terminates in a sternal pad 681. A threaded shaft carrier 607 extends upwardly from the drive base 601 adjacent the blade arm 640. An inferior blade 650 having a tissue retractor 670 extending therefrom attaches to the blade arm 640. In a preferred construction, the inferior blade 650, tissue retractor 670, blade arm 640, threaded shaft carrier 607, drive base 601, pad arm 683, and sternal pad 681 are formed from one-piece construction.

A hollow threaded shaft 603 is threaded through the shaft carrier 607 and extends along the drive base 601 to rotatably attach to a hollow drive block 609. A spreader handle 605 is attached to the shaft 603 at an end opposite the drive block 609. A worm gear 697 positioned in the drive block 609, is fixed to the end of a shaft 696 that passes through the hollow threaded shaft 603 and attaches to an offset handle 695 beyond the spreader handle 605. The worm gear 697 is operably connected to an arcuate worm gear rack 698 that is positioned within the drive block 609 and connected to a branch 643 of a blade arm 642. The branch 643 of the blade arm 642 extends from the blade arm 642 in a normal direction and is pivotally mounted to the hollow drive block 609. The blade arm 642 extends downwardly from the branch 643 and attaches to a superior blade 652 with a tissue retractor 672 extending therefrom. A follower 619 extends downwardly from the base of the hollow drive block 609 and is received in a elongated drive slot 611 in the drive base 601. As the drive block 609 is transversely driven along the base 601 by the threaded shaft 603, the follower 609 slidably follows the drive slot 611 in the drive base 601;"

page 54, line 16-page 55, line 19: "Referring to Figures 31 and 32, a fourteenth embodiment of the access platform 610 of the present invention comprises a spreader component 612 that includes a rack 613, a spreader base 614 attached to one end of the rack 613 and a pinion housing 620 slidably received over the rack 613. A pinion 621 that is driven by a lever 622 is rotatably retained in the pinion housing 620 and operably connected to the rack 613.

A fixed pivot 616 having a socket 618 formed therein, extends from the spreader base 614. A fixed pivot lock 615 with a lock screw 617 is fixedly connected to the fixed pivot 616. A moveable pivot 624 having a socket 625 formed therein, extends from the housing 620. Rotatably and releasably received in and extending from the sockets 618 and 625 are stem portions 644 and 646 of a pair of blade arms 640 and 642, respectively. The stem 644 that is received in the socket 618 of the fixed pivot 616 includes a stop 645 formed on its exterior to abut the fixed pivot lock 615 and stop the travel of the stem 644. Branch portions 641 and 643 of the blade arms 640 and 642 extend downwardly from the stem portions 644 and 646 and attach to inferior and superior blades 650 and 652, respectively. The superior blade 652 which is advantageously located below and interconnected to the moveable pivot 624, comprises a recessed throat 654 to capture a rib adjacent to an incision in the patient's chest cavity and a pair of elongated vanes 656 and 657 used to offset a plurality of the patient's ribs. The inferior blade 650 which is interconnected to the fixed pivot 616 comprises a recessed throat 653 used to capture a rib adjacent to an incision in the patient's chest cavity;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 64, line 5-page 67, line 5: " Referring to Figure 39, a sixteenth embodiment of an access platform 780 comprises a generally elongated drive base 781 having a blade arm 782 extended generally in a normal direction from the drive base 781. A generally arcuate pad arm 786 extends generally longitudinally and downwardly from the drive base 781 and terminates at a sternal pad 785. A bearing support 791 extends upwardly from the drive base 781 adjacent the blade arm 782. An inferior blade 783 having a tissue retractor 784 extending therefrom attaches to the end of the inferior blade arm 782. In a preferred construction, the inferior blade 781, tissue retractor 784, blade arm 782, bearing support 791, drive base 781, pad arm 786 and sternal pad 785 are formed from one-piece construction.

A bearing 792 is mounted to the bearing support 791 and has a spreader handle 793 operably coupled thereto. A drive screw 787 having an offset handle 794 with a lever 795 attached to its first end, is threaded through the spreader handle 793 and freely passes through the bearing 792 and bearing support 791. The drive screw 787 extends longitudinally along the drive base 781 and is threaded through a carrier mount 789. The spreader handle 793 and the carrier mount 789 include oppositely wound threads. Rotation of the spreader handle 793 transversely drives the drive screw 787 and the carrier mount 789 mounted thereon along the drive base 781 and, thus, spreads or closes the blades 783 and 796. The carrier mount 789 includes a follower extending downwardly from its base that inserts into a drive slot 788 in the base 781. As the carrier mount 789 is translated across the drive base 781, the follower slides along the drive slot 788.

Extending upwardly and longitudinally outwardly in a direction away from the spreader handle 793, a carrier arm 790 extends from the carrier 789. At an end opposite the carrier mount 789, the carrier arm 790 pivotally captures at a pivot 799 a branch 797A of a blade arm 797. A tab 779 is fixed to the branch 797A adjacent the pivot 799 and extends downwardly in a direction normal to the branch 797A. The tab 779 contacts a shaft-end 787A of the drive shaft 787 opposite the offset handle 794 and extending beyond the carrier 789. The branch 797A extends outwardly from the pivot 799 in a normal direction to the carrier arm 790 and couples to the blade arm 797 at an end opposite the carrier arm 790. The blade arm 797 is generally arcuately shaped and extends downwardly from the branch 797A to connect to a superior blade 796 with a tissue retractor 798 extending therefrom. Because the pivot 799 is located above the superior blade 796, a lifting force is exerted on the superior blade 796 and ribs as a spreading force from the inferior blade 783 is transmitted to the superior blade 796 through the pivot 799.

Rotation of the offset handle 794, while holding the spreader handle 793 stationary, will thread the drive screw 787 through both the spreader handle 793 and the carrier 789, and thereby cause the drive screw 787 and carrier 789 to traverse the drive base 781 as well as causing the carrier 789 to traverse the drive screw 787 in the same direction. As a result, the carrier 789 traverses the drive base 781 at approximately two-times the speed that the carrier 789 traverses the drive screw 787 and thus, the length of the shaft-end 787A extending beyond the carrier 789 will increase or decrease at approximately one-half the speed at which the carrier 789 traverses the drive base 781. Therefore, as the offset handle 794 is rotated in a direction to spread the ribs, the ribs will be raised at a rate slower than they are spread as the superior blade 796 naturally rotates about the pivot 799 as the length of the shaft-end 787A extending beyond the carrier 789 decreases. Similarly, as the offset handle 794 is rotated in a direction to lower the offset ribs, the length of the shaft-end 787A will increase, at a rate slower than the rate at which the carrier 789 traverses the drive base 781. As the length of the shaft end 787A increases, it forces the tab 779, and thus the superior blade 797, to rotate in the counterclockwise direction around the pivot 799, and thereby further lowers the ribs. Because the carrier 789 traverses the drive base 781 at a faster rate than the shaft-end 787A increases, the distance between the blades 783 and 796 along the drive base 781 tends to decrease as the ribs are lowered;"

page 70, line 3-page 71, line 10: "Turning to Figure 40, a seventeenth embodiment of the access platform 800 comprises a spreader housing 801 which includes a drive mechanism housed therein (not shown) and a drive slot 803 cut into the spreader housing 801. A spreader lever 802 is mounted on the top of the spreader housing 801 and is operably connected to the drive mechanism housed therein. An inferior blade 805 having a tissue retractor 804 extending therefrom, is interconnected to the drive mechanism via a blade arm 806. The blade arm 806 extends outwardly from the spreader housing 801 in a generally normal direction.

A pad arm 817 connects at one end, or is formed integrally therewith, to the spreader housing 801 and extends outwardly therefrom. A sternal pad 816 is integrally formed on the pad arm 817 at an end opposite the housing 801. The pad arm 817 is generally arcuate to conform to an extended rib cage due to the offset of the ribs.

A superior blade 820 having a tissue retractor 821 extending therefrom, is connected to the bottom end of a generally arcuately shaped blade arm 818. The top end of the blade arm 818 is pivotally mounted on an offset stanchion 815 that extends upwardly from the pad arm 817. A compression member 813 is pivotally connected to the top of the stanchion 815 at pivot 814 and extends inwardly from the stanchion 815 toward the lever 802 on the spreader housing 801. An offset screw 811 having a handle 812 attached to its top end, is threaded through the compression member 813 at an end opposite the pivot 814 and is rotatably captured by a bushing assembly 808 rotatably coupled to a mount 807 that extends upwardly from the spreader housing 801. A counter-lift tab 809 extends inwardly from the blade arm 818 adjacent the stanchion 815. The lift tab 809 is operably connected to the compression member 813 through an offset spring 810 mounted therebetween;"

<p>a second blade mounted on said second blade arm;</p>	<p>See, e.g., page 9, lines 2-10: "The access platform of the present invention is preferably capable of laterally spreading the ribs, vertically displacing the opposingly retracted ribs relative to each other and depressing the sternum to cause a "tunnel" effect under the retracted ribs. Moreover, it is preferably self-contained such that the force necessary to spread and vertically displace the ribs is applied by the access platform itself rather than through additional external devices. The access platform preferably comprises first and second blades interconnected to a spreader member that laterally drives the blades apart or together, a sternal pad interconnected to the blades, and a vertical displacement member interconnected to a blade and the spreader member. The vertical displacement member may preferably be bi-directional to cause the interconnected blade to be vertically displaced in either direction and, thus, increases the surgeon's working space and visual access to the IMA;"</p> <p>page 19, lines 4-7: " Preferably, the access platform 10 comprises a pair of blades 50 and 51, a pair of support pads 80 and 81, a pair of tissue retractors 70 and 71, a pair of torsional members 30 and 31, and a spreader member 12;"</p> <p>page 21, lines 6-12: " Referring to Figure 2, the blades 50 and 51 preferably include elongated vanes 52 and 53, which slide beneath a plurality of the patient's ribs, and recessed arcuate throats 54 and 55 that receive the patient's ribs that are adjacent to the chest incision. The benefits of the recessed throats 54 and 55 and the elongated vanes 52 and 53 will be discussed below with regard to the operation of the access platform 10;"</p> <p>page 33, lines 6-14: " The blade arms 146 and 147 further comprise pivot sections 150 and 151 extending horizontally from the stems 152 and 153. Branches 148 and 149 extend downwardly and outwardly from the pivot sections 150 and 151 of the blade arms 146 and 147 to position the remainder of the access platform 110 away from the surgeon's working area. Branches 148 and 149 attach to blades 140 and 141. The blades 140 and 141 comprise elongated vane sections 142 and 143 extending outwardly from recessed throat sections 144 and 145;"</p> <p>page 39, lines 3-5: " A pair of blade arms 338 and 340 include branch sections 346 and 348 that extend downwardly from central portions 339 and 341 and connect to blades 350 and 352;"</p> <p>page 42, lines 3-19: "A sixth embodiment of the access platform 310 is shown in Figure 22 to comprise a combination of components from the first and fourth embodiments (Figures 2 and 18). More particularly, the torsional members 30 and 31 of the first embodiment are interposed between and operably connected to the fingers 330A and 330B and the housing 322, and interposed between and operably connected to the fingers 332A and 332B and the spreader base 328, respectively. In addition, the support pads 80 and 81 of the first embodiment are adjustably attached to the fingers 330A and 330B, 332A and 332B. By including the torsional members 30 and 31 and the support pads 80 and 81, second and third axes of rotation A₂ and A₃ are provided. Thus, as in the first embodiment, the torsional members 30 and 31 enable the access platform 310 to vertically displace the blades 350 and 352 and the retracted ribs. To vertically displace the blades 350 and 352, the blade arms 338 and 340 are fixedly coupled to the fingers 330A and 330B, 332A and 332B by pins 334 and 336.;"</p>
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page 42, line 20 - page 43, line 21: "Turning to Figure 23, a seventh embodiment of the access platform is shown to comprise a modification of the fifth embodiment of the access platform shown in Figure 19. The access platform 310 in Figure 23 includes an offset assembly 308 interconnected to the blades 350 and 352. The offset assembly 308 comprises lead screws 313 and 314 extending between the blades 350 and 352 and further operably interconnecting the blades 350 and 352. At a first end, the lead screws 313 and 314 are rotatably captured by capture mounts 317 and 318. The capture mounts 317 and 318 are fixed to the blade 350. The threaded portion of the lead screws 313 and 314 threadably passes through a pair of lift mounts 315 and 316. The lift mount 315 is affixed to the blade arm 340 which is interconnected to the superior blade 352. The lift mount 316 is affixed to the top of a lift mount arm 319 extending vertically from the superior blade 352 to a height which is level with the lift mount 315 on the blade arm 340. Levers 309 and 311, which are attached to a second end of the lead screws 313 and 314, are used to rotate the lead screws 313 and 314 to drive the lift mounts 315 and 316 thereon. With the horizontal distance between the inferior and superior blades 350 and 352 adjustably fixed by the spreader member 312, the offset assembly 308 is only able to vertically displace the blade 352 relative to the blade 350. Thus, depending on the direction of rotation of the lead screws 313 and 314, the superior blade 352 will be raised or lowered to offset it relative to the inferior blade 350;"

page 45, line 3-page 46, line 5: "Turning to Figure 26, a ninth embodiment of the access platform 410 of the present invention is shown. The access platform 410 mounts to the table or rail via slides 438 and 440 that are locked in place by positioners 450 and 452. The slides 438 and 440 rotatably retain pinions 442 and 444 driven by levers 446 and 448 and slidably receive stanchion racks 430 and 432. The stanchion racks 430 and 432 include rack gears 434 and 436 that operably couple with pinions 442 and 444. The levers 446 and 448 are rotated to drive the pinions 442 and 444 along rack gears 434 and 436 to adjust the height of the stanchion racks 430 and 432 relative to the table or patient, or to vertically offset blades 470 and 472 relative to one another.

A pinion housing 422 is slidably attached to the stanchion rack 432 towards its upper end. A rack 420 is attached at one end to stanchion rack 430 and is slidably received in the pinion housing 422. A pinion 424 driven by a lever 426 is rotatably retained in the pinion housing 422 and operably connected to the rack 420. The lever 426 is rotated to drive the pinion 424 along the rack 420 to spread apart the stanchion racks 430 and 432 and effectively a patient's ribs.

Torsional members 460 and 462 are attached to the top of the stanchion racks 430 and 432. Blade arms 474 and 476 extend outwardly from torsional members and attach to the blades 470 and 472. The torsional members comprise inner hubs 461 and 465 rotatably received in and operably connected to outer hubs 463 and 467. Locking levers 464 and 466 lock the inner hubs 461 and 465 in place relative to the outer hubs 463 and 467;"

page 48, lines 1-11: "Turning to Figure 28, an eleventh embodiment of the access platform 651 comprises a spreader housing 602 that includes a drive mechanism therein (not shown) and a drive slot 608 formed therein. A spreader lever 604 is mounted on top of the spreader housing 602 and is operably connected to the drive mechanism housed therein. An inferior blade 650 is interconnected to the drive mechanism via a blade arm 640 which extends outwardly to the inferior blade 650 from the spreader housing 602 in a direction generally normal to the housing 602. A tissue retractor 670 is attached to the blade 650 to assist in tissue retraction;"

page 50, line 17-page 51, line 9: "Referring to Figure 29, a twelfth embodiment of an access platform 659 is shown to comprise a modification of the eleventh embodiment of the access platform 651 shown in Figure 28. The offset assembly 690 of the access platform includes an offset housing 691 extending upwardly from the spreader housing 602 and adapted to slidably receive a curved rack 692. The blade arm 642 is attached to the curved rack 692 through a slot 699 in the housing 691. A worm gear 693 is positioned within the housing 691 and is operably connected to the curved rack 692. A worm gear shaft 689 extends from the worm gear 693 and connects to a lever 694 outside of the housing 691. Thus, to lift the superior blade 652 and ribs, the lever 694 is rotated in an appropriate direction to rotate the worm gear 693 to drive the curved rack 692 upwardly and outwardly from the housing 691. To lower the superior blade 652 from the offset position, the lever 694 is reverse rotated to drive the curved rack 692 in an opposite direction;"

page 51, line 10-page 52, line 20: " Turning to Figure 30, a thirteenth embodiment of the access platform 655 of the present invention comprises a generally elongated drive base 601 having a blade arm 640 and a pad arm 683 extending therefrom. The blade arm 640 extends in a generally normal direction from the drive base 601, while the pad arm 683, which is generally arcuately shaped, extends longitudinally and downwardly from the drive base 601. The pad arm 683 terminates in a sternal pad 681. A threaded shaft carrier 607 extends upwardly from the drive base 601 adjacent the blade arm 640. An inferior blade 650 having a tissue retractor 670 extending therefrom attaches to the blade arm 640. In a preferred construction, the inferior blade 650, tissue retractor 670, blade arm 640, threaded shaft carrier 607, drive base 601, pad arm 683, and sternal pad 681 are formed from one-piece construction.

A hollow threaded shaft 603 is threaded through the shaft carrier 607 and extends along the drive base 601 to rotatably attach to a hollow drive block 609. A spreader handle 605 is attached to the shaft 603 at an end opposite the drive block 609. A worm gear 697 positioned in the drive block 609, is fixed to the end of a shaft 696 that passes through the hollow threaded shaft 603 and attaches to an offset handle 695 beyond the spreader handle 605. The worm gear 697 is operably connected to an arcuate worm gear rack 698 that is positioned within the drive block 609 and connected to a branch 643 of a blade arm 642. The branch 643 of the blade arm 642 extends from the blade arm 642 in a normal direction and is pivotally mounted to the hollow drive block 609. The blade arm 642 extends downwardly from the branch 643 and attaches to a superior blade 652 with a tissue retractor 672 extending therefrom. A follower 619 extends downwardly from the base of the hollow drive block 609 and is received in a elongated drive slot 611 in the drive base 601. As the drive block 609 is transversely driven along the base 601 by the threaded shaft 603, the follower 609 slidably follows the drive slot 611 in the drive base 601;"

page 54, line 16-page 55, line 19: "Referring to Figures 31 and 32, a fourteenth embodiment of the access platform 610 of the present invention comprises a spreader component 612 that includes a rack 613, a spreader base 614 attached to one end of the rack 613 and a pinion housing 620 slidably received over the rack 613. A pinion 621 that is driven by a lever 622 is rotatably retained in the pinion housing 620 and operably connected to the rack 613.

A fixed pivot 616 having a socket 618 formed therein, extends from the spreader base 614. A fixed pivot lock 615 with a lock screw 617 is fixedly connected to the fixed pivot 616. A moveable pivot 624 having a socket 625 formed therein, extends from the housing 620. Rotatably and releasably received in and extending from the sockets 618 and 625 are stem portions 644 and 646 of a pair of blade arms 640 and 642, respectively. The stem 644 that is received in the socket 618 of the fixed pivot 616 includes a stop 645 formed on its exterior to abut the fixed pivot lock 615 and stop the travel of the stem 644. Branch portions 641 and 643 of the blade arms 640 and 642 extend downwardly from the stem portions 644 and 646 and attach to inferior and superior blades 650 and 652, respectively. The superior blade 652 which is advantageously located below and interconnected to the moveable pivot 624, comprises a recessed throat 654 to capture a rib adjacent to an incision in the patient's chest cavity and a pair of elongated vanes 656 and 657 used to offset a plurality of the patient's ribs. The inferior blade 650 which is interconnected to the fixed pivot 616 comprises a recessed throat 653 used to capture a rib adjacent to an incision in the patient's chest cavity;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 64, line 5-page 67, line 5: " Referring to Figure 39, a sixteenth embodiment of an access platform 780 comprises a generally elongated drive base 781 having a blade arm 782 extended generally in a normal direction from the drive base 781. A generally arcuate pad arm 786 extends generally longitudinally and downwardly from the drive base 781 and terminates at a sternal pad 785. A bearing support 791 extends upwardly from the drive base 781 adjacent the blade arm 782. An inferior blade 783 having a tissue retractor 784 extending therefrom attaches to the end of the inferior blade arm 782. In a preferred construction, the inferior blade 781, tissue retractor 784, blade arm 782, bearing support 791, drive base 781, pad arm 786 and sternal pad 785 are formed from one-piece construction.

A bearing 792 is mounted to the bearing support 791 and has a spreader handle 793 operably coupled thereto. A drive screw 787 having an offset handle 794 with a lever 795 attached to its first end, is threaded through the spreader handle 793 and freely passes through the bearing 792 and bearing support 791. The drive screw 787 extends longitudinally along the drive base 781 and is threaded through a carrier mount 789. The spreader handle 793 and the carrier mount 789 include oppositely wound threads. Rotation of the spreader handle 793 transversely drives the drive screw 787 and the carrier mount 789 mounted thereon along the drive base 781 and, thus, spreads or closes the blades 783 and 796. The carrier mount 789 includes a follower extending downwardly from its base that inserts into a drive slot 788 in the base 781. As the carrier mount 789 is translated across the drive base 781, the follower slides along the drive slot 788.

Extending upwardly and longitudinally outwardly in a direction away from the spreader handle 793, a carrier arm 790 extends from the carrier 789. At an end opposite the carrier mount 789, the carrier arm 790 pivotally captures at a pivot 799 a branch 797A of a blade arm 797. A tab 779 is fixed to the branch 797A adjacent the pivot 799 and extends downwardly in a direction normal to the branch 797A. The tab 779 contacts a shaft-end 787A of the drive shaft 787 opposite the offset handle 794 and extending beyond the carrier 789. The branch 797A extends outwardly from the pivot 799 in a normal direction to the carrier arm 790 and couples to the blade arm 797 at an end opposite the carrier arm 790. The blade arm 797 is generally arcuately shaped and extends downwardly from the branch 797A to connect to a superior blade 796 with a tissue retractor 798 extending therefrom. Because the pivot 799 is located above the superior blade 796, a lifting force is exerted on the superior blade 796 and ribs as a spreading force from the inferior blade 783 is transmitted to the superior blade 796 through the pivot 799.

Rotation of the offset handle 794, while holding the spreader handle 793 stationary, will thread the drive screw 787 through both the spreader handle 793 and the carrier 789, and thereby cause the drive screw 787 and carrier 789 to traverse the drive base 781 as well as causing the carrier 789 to traverse the drive screw 787 in the same direction. As a result, the carrier 789 traverses the drive base 781 at approximately two-times the speed that the carrier 789 traverses the drive screw 787 and thus, the length of the shaft-end 787A extending beyond the carrier 789 will increase or decrease at approximately one-half the speed at which the carrier 789 traverses the drive base 781. Therefore, as the offset handle 794 is rotated in a direction to spread the ribs, the ribs will be raised at a rate slower than they are spread as the superior blade 796 naturally rotates about the pivot 799 as the length of the shaft-end 787A extending beyond the carrier 789 decreases. Similarly, as the offset handle 794 is rotated in a direction to lower the offset ribs, the length of the shaft-end 787A will increase, at a rate slower than the rate at which the carrier 789 traverses the drive base 781. As the length of the shaft end 787A increases, it forces the tab 779, and thus the superior blade 797, to rotate in the counterclockwise direction around the pivot 799, and thereby further lowers the ribs. Because the carrier 789 traverses the drive base 781 at a faster rate than the shaft-end 787A increases, the distance between the blades 783 and 796 along the drive base 781 tends to decrease as the ribs are lowered;"

page 70, line 3-page 71, line 10: "Turning to Figure 40, a seventeenth embodiment of the access platform 800 comprises a spreader housing 801 which includes a drive mechanism housed therein (not shown) and a drive slot 803 cut into the spreader housing 801. A spreader lever 802 is mounted on the top of the spreader housing 801 and is operably connected to the drive mechanism housed therein. An inferior blade 805 having a tissue retractor 804 extending therefrom, is interconnected to the drive mechanism via a blade arm 806. The blade arm 806 extends outwardly from the spreader housing 801 in a generally normal direction.

A pad arm 817 connects at one end, or is formed integrally therewith, to the spreader housing 801 and extends outwardly therefrom. A sternal pad 816 is integrally formed on the pad arm 817 at an end opposite the housing 801. The pad arm 817 is generally arcuate to conform to an extended rib cage due to the offset of the ribs.

A superior blade 820 having a tissue retractor 821 extending therefrom, is connected to the bottom end of a generally arcuately shaped blade arm 818. The top end of the blade arm 818 is pivotally mounted on an offset stanchion 815 that extends upwardly from the pad arm 817. A compression member 813 is pivotally connected to the top of the stanchion 815 at pivot 814 and extends inwardly from the stanchion 815 toward the lever 802 on the spreader housing 801. An offset screw 811 having a handle 812 attached to its top end, is threaded through the compression member 813 at an end opposite the pivot 814 and is rotatably captured by a bushing assembly 808 rotatably coupled to a mount 807 that extends upwardly from the spreader housing 801. A counter-lift tab 809 extends inwardly from the blade arm 818 adjacent the stanchion 815. The lift tab 809 is operably connected to the compression member 813 through an offset spring 810 mounted therebetween;"

<p>an offset member adapted to lift said second blade relative to said first blade to lift a portion of a ribcage to provide improved access to the intermammary artery.</p>	<p>See, e.g., page 9, lines 2-10: " The access platform of the present invention is preferably capable of laterally spreading the ribs, vertically displacing the opposingly retracted ribs relative to each other and depressing the sternum to cause a "tunnel" effect under the retracted ribs. Moreover, it is preferably self-contained such that the force necessary to spread and vertically displace the ribs is applied by the access platform itself rather than through additional external devices. The access platform preferably comprises first and second blades interconnected to a spreader member that laterally drives the blades apart or together, a sternal pad interconnected to the blades, and a vertical displacement member interconnected to a blade and the spreader member. The vertical displacement member may preferably be bi-directional to cause the interconnected blade to be vertically displaced in either direction and, thus, increases the surgeon's working space and visual access to the IMA;"</p>
	<p>page 19, lines 4-23: "Preferably, the access platform 10 comprises a pair of blades 50 and 51, a pair of support pads 80 and 81, a pair of tissue retractors 70 and 71, a pair of torsional members 30 and 31, and a spreader member 12. The torsional members 30 and 31 and the spreader member 12 preferably extend away from the blades 50 and 51 and the tissue retractors 70 and 71 and, thus, the chest incision, in a plane relatively parallel to the patient's chest. As a result, the access platform 10 advantageously maintains a low profile that remains substantially clear of the surgeon's working space.</p>
	<p>Referring to Figure 2, the components of the access platform 10 are shown less the tissue retractors 70 and 71. The spreader member 12 preferably comprises a rotatable hub 14 including operably coupled upper and lower hub halves 17 and 16. A pair of spreader arms 19 and 18 extend from the upper and lower hub halves 17 and 16, respectively, and connect to the torsional members 31 and 30, respectively. Preferably, the hub 14 includes a harmonic gear drive 20 used to rotate the upper hub half 17 relative to the lower hub half 16 and, thus, spread or close the spreader arms 18 and 19 to retract or relax the patient's ribs;"</p>
	<p>page 23, lines 1-18: " The torsional members 30 and 31 are operably connected to the torque bases 32 and 33 and the spreader arms 18 and 19 to enable the access platform 10 to both laterally retract and vertically displace a patient's ribs. Thus, the torsional members 30 and 31 enable the access platform 10 to be advantageously self-contained such that the force necessary to spread and vertically displace a patient's ribs, and the force necessary to depress the patient's sternum, is applied by the access platform 10 itself rather than through additional external devices.</p>
	<p>The torsional members 30 and 31 preferably comprise a reduction gear assembly 40 (see Figure 4). The reduction gear assembly 40, as shown for torsional member 31, comprises a drive nut 42 rotatably captured on the end of the shaft of the spreader arm 19, a first shaft 45 axially extending from the spreader arm 19, and a second shaft 47 extending from the torque base 33. The second shaft 47 is rotatably captured over the first shaft 45 by a shoulder screw 49;"</p>

page 32, line 21-page 33, line 5: " Vertical displacement members 130 and 131 preferably comprise curved racks 132 and 133 slidably received within pinion housings 134 and 135. The pinion housings 134 and 135 are fixedly attached to the pinion housings 122 and 121. The pinion housings 134 and 135 rotatably retain pinions 136 and 137 driven by levers 138 and 139. Sockets 154 and 155 are formed in the lower ends of the curved racks 132 and 133. Stems 152 and 153 of blade arms 146 and 147 are releasably received by and horizontally extend from the sockets 154 and 155;"

page 37, lines 12-19: " A vertical displacement member 250 comprises a support pad 252 that pivotally connects to the pinion housing 216 at a pivot 254 and extends laterally away from the pinion housing 216. An "L"-shaped lever 256 is pivotally connected to the rack 214 at a pivot 258 at the end of the short leg of the "L"-shaped lever 256. A slide 259 is formed at the intersection of the short and long legs of the "L"-shaped lever 256. The slide 259 slidably contacts the support pad 252;"

page 38, lines 4-11: "The "L"-shaped lever 256 is then rotated downwardly in a counterclockwise direction toward the patient's chest such that the slide portion 259 slides along the support pad 252 toward the housing 220 while the "L"-shaped lever 256 rotates about the pivot 258. As a result, one end of the rack 214 is raised to vertically offset blade 230 and ribs R relative to the blade 231 and ribs R;"

page 41, lines 1-10: " Turning to Figures 20 and 21, a pry bar 370, which is used in conjunction with the access platform 310 shown in Figure 18 or 19 to offset a patient's ribs, comprises a generally "S"-shaped body 372 pivotally connected to a pivot base 377 at pivot 378. The pivot base 377 is in turn pivotally connected to a blade arm 382 at pivot 380. The blade arm 382 extends downwardly from the pivot 380 and connects to a blade 384. The blade 384 includes an elongated vane 386 and a deep recessed throat 388. A sternal pad 374 is connected to a post 379 that is slidably mounted on the lower portion 373 of the "S"-shaped body 372 via a slide 376;"

page 42, lines 3-19: "A sixth embodiment of the access platform 310 is shown in Figure 22 to comprise a combination of components from the first and fourth embodiments (Figures 2 and 18). More particularly, the torsional members 30 and 31 of the first embodiment are interposed between and operably connected to the fingers 330A and 330B and the housing 322, and interposed between and operably connected to the fingers 332A and 332B and the spreader base 328, respectively. In addition, the support pads 80 and 81 of the first embodiment are adjustably attached to the fingers 330A and 330B, 332A and 332B. By including the torsional members 30 and 31 and the support pads 80 and 81, second and third axes of rotation A_2 and A_3 are provided. Thus, as in the first embodiment, the torsional members 30 and 31 enable the access platform 310 to vertically displace the blades 350 and 352 and the retracted ribs. To vertically displace the blades 350 and 352, the blade arms 338 and 340 are fixedly coupled to the fingers 330A and 330B, 332A and 332B by pins 334 and 336.;"

page 42, line 20 - page 43, line 21: "Turning to Figure 23, a seventh embodiment of the access platform is shown to comprise a modification of the fifth embodiment of the access platform shown in Figure 19. The access platform 310 in Figure 23 includes an offset assembly 308 interconnected to the blades 350 and 352. The offset assembly 308 comprises lead screws 313 and 314 extending between the blades 350 and 352 and further operably interconnecting the blades 350 and 352. At a first end, the lead screws 313 and 314 are rotatably captured by capture mounts 317 and 318. The capture mounts 317 and 318 are fixed to the blade 350. The threaded portion of the lead screws 313 and 314 threadably passes through a pair of lift mounts 315 and 316. The lift mount 315 is affixed to the blade arm 340 which is interconnected to the superior blade 352. The lift mount 316 is affixed to the top of a lift mount arm 319 extending vertically from the superior blade 352 to a height which is level with the lift mount 315 on the blade arm 340. Levers 309 and 311, which are attached to a second end of the lead screws 313 and 314, are used to rotate the lead screws 313 and 314 to drive the lift mounts 315 and 316 thereon. With the horizontal distance between the inferior and superior blades 350 and 352 adjustably fixed by the spreader member 312, the offset assembly 308 is only able to vertically displace the blade 352 relative to the blade 350. Thus, depending on the direction of rotation of the lead screws 313 and 314, the superior blade 352 will be raised or lowered to offset it relative to the inferior blade 350;"

page 45, line 23-page 46, line 21: " Torsional members 460 and 462 are attached to the top of the stanchion racks 430 and 432. Blade arms 474 and 476 extend outwardly from torsional members and attach to the blades 470 and 472. The torsional members comprise inner hubs 461 and 465 rotatably received in and operably connected to outer hubs 463 and 467. Locking levers 464 and 466 lock the inner hubs 461 and 465 in place relative to the outer hubs 463 and 467.

In operation, the access platform 410 is positioned such that the blades 470 and 472 can be inserted into an incision in a patient's chest and then attached to the blade arms 474 and 476. Once the blades 470 and 472 are positioned in the incision and attached to the blade arms 474 and 476, the lever 426 is rotated to spread the blades 470 and 472 and the patient's ribs apart. The blades 470 and 472 can be effectively offset by rotating the inner hubs 461 and 465 relative to the outer hubs 463 and 467. While the blades 470 and 472 are rotated, the stanchion racks 430 and 432 can be raised or lowered by rotating levers 486 and 488 to drive pinions 442 and 444. By raising or lowering the stanchion racks 430 and 432, the blades 470 and 472 can be effectively raised or lowered relative to one another to further offset the blades 470 and 472 relative to one another. A wrench 468 is utilized to rotate the inner hubs 461 and 465 relative to the outer hubs 463 and 467;"

page 48, line 16-page 49, line 5: " A superior blade 652 having a tissue retractor 672 extending therefrom is connected to the bottom end of a blade arm 642. The top end of the blade arm 642 is pivotally connected to an offset drive assembly 660. The offset drive assembly 660 comprises a guide link 666 and a drive link 665 which are pivotally connected at pivots 687 and 688 to a mount 685 extending upwardly from the pad arm 683 and at pivots 668 and 667 to the blade arm 642. The drive link 665 is also pivotally connected to a drive carrier 662 which threadably captures a lead screw 661 and is transversely driven along the lead screw 661 as the lead screw 661 is rotated. A lever 664 is attached to the top of the lead screw 661 to rotate the lead screw 661. The base of the lead screw 661 is rotatably captured in a bushing 663 which is rotatably captured in a drive mount 606 extending up from the spreader housing 602;"

page 50, line 17-page 51, line 9: "Referring to Figure 29, a twelfth embodiment of an access platform 659 is shown to comprise a modification of the eleventh embodiment of the access platform 651 shown in Figure 28. The offset assembly 690 of the access platform includes an offset housing 691 extending upwardly from the spreader housing 602 and adapted to slidably receive a curved rack 692. The blade arm 642 is attached to the curved rack 692 through a slot 699 in the housing 691. A worm gear 693 is positioned within the housing 691 and is operably connected to the curved rack 692. A worm gear shaft 689 extends from the worm gear 693 and connects to a lever 694 outside of the housing 691. Thus, to lift the superior blade 652 and ribs, the lever 694 is rotated in an appropriate direction to rotate the worm gear 693 to drive the curved rack 692 upwardly and outwardly from the housing 691. To lower the superior blade 652 from the offset position, the lever 694 is reverse rotated to drive the curved rack 692 in an opposite direction;"

page 51, line 10-page 52, line 20: " Turning to Figure 30, a thirteenth embodiment of the access platform 655 of the present invention comprises a generally elongated drive base 601 having a blade arm 640 and a pad arm 683 extending therefrom. The blade arm 640 extends in a generally normal direction from the drive base 601, while the pad arm 683, which is generally arcuately shaped, extends longitudinally and downwardly from the drive base 601. The pad arm 683 terminates in a sternal pad 681. A threaded shaft carrier 607 extends upwardly from the drive base 601 adjacent the blade arm 640. An inferior blade 650 having a tissue retractor 670 extending therefrom attaches to the blade arm 640. In a preferred construction, the inferior blade 650, tissue retractor 670, blade arm 640, threaded shaft carrier 607, drive base 601, pad arm 683, and sternal pad 681 are formed from one-piece construction.

A hollow threaded shaft 603 is threaded through the shaft carrier 607 and extends along the drive base 601 to rotatably attach to a hollow drive block 609. A spreader handle 605 is attached to the shaft 603 at an end opposite the drive block 609. A worm gear 697 positioned in the drive block 609, is fixed to the end of a shaft 696 that passes through the hollow threaded shaft 603 and attaches to an offset handle 695 beyond the spreader handle 605. The worm gear 697 is operably connected to an arcuate worm gear rack 698 that is positioned within the drive block 609 and connected to a branch 643 of a blade arm 642. The branch 643 of the blade arm 642 extends from the blade arm 642 in a normal direction and is pivotally mounted to the hollow drive block 609. The blade arm 642 extends downwardly from the branch 643 and attaches to a superior blade 652 with a tissue retractor 672 extending therefrom. A follower 619 extends downwardly from the base of the hollow drive block 609 and is received in a elongated drive slot 611 in the drive base 601. As the drive block 609 is transversely driven along the base 601 by the threaded shaft 603, the follower 609 slidably follows the drive slot 611 in the drive base 601;"

page 56, line 3-page 57, line 22: " The branch portion 643 of the blade arm 642 that is interconnected to the moveable pivot 624 extends higher vertically than the branch portion 641 of the blade arm 640 that is interconnected to the fixed pivot 616 when the blades 650 and 652 are substantially level (see Figure 29). This construction tends to increase the moment about the moveable pivot 624 caused by the offset of the movable pivot from the center-of-effort of the spreading force at the blades 650 and 652. Because the movable pivot 624 is located above the superior blade 652, a lifting force is naturally exerted on the superior blade 652 and ribs as spreading occurs.

To add additional offset of the superior blade 652 once the blades 650 and 652 are separated and offset, a vertical displacement component 630 is included on the access platform 610. The vertical displacement component 630 comprises a rib compression shoe 680, a substantially "S" shaped shoe arm 682 connected to the shoe 680 at one end and pivotally connected to the stem 646 of the blade arm 642 at the other end, and an adjustable offset link 632 connected to the pinion housing 620 and operably connected to the shoe arm 682 and shoe 680;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 64, line 5-page 67, line 5: " Referring to Figure 39, a sixteenth embodiment of an access platform 780 comprises a generally elongated drive base 781 having a blade arm 782 extended generally in a normal direction from the drive base 781. A generally arcuate pad arm 786 extends generally longitudinally and downwardly from the drive base 781 and terminates at a sternal pad 785. A bearing support 791 extends upwardly from the drive base 781 adjacent the blade arm 782. An inferior blade 783 having a tissue retractor 784 extending therefrom attaches to the end of the inferior blade arm 782. In a preferred construction, the inferior blade 781, tissue retractor 784, blade arm 782, bearing support 791, drive base 781, pad arm 786 and sternal pad 785 are formed from one-piece construction.

A bearing 792 is mounted to the bearing support 791 and has a spreader handle 793 operably coupled thereto. A drive screw 787 having an offset handle 794 with a lever 795 attached to its first end, is threaded through the spreader handle 793 and freely passes through the bearing 792 and bearing support 791. The drive screw 787 extends longitudinally along the drive base 781 and is threaded through a carrier mount 789. The spreader handle 793 and the carrier mount 789 include oppositely wound threads. Rotation of the spreader handle 793 transversely drives the drive screw 787 and the carrier mount 789 mounted thereon along the drive base 781 and, thus, spreads or closes the blades 783 and 796. The carrier mount 789 includes a follower extending downwardly from its base that inserts into a drive slot 788 in the base 781. As the carrier mount 789 is translated across the drive base 781, the follower slides along the drive slot 788.

Extending upwardly and longitudinally outwardly in a direction away from the spreader handle 793, a carrier arm 790 extends from the carrier 789. At an end opposite the carrier mount 789, the carrier arm 790 pivotally captures at a pivot 799 a branch 797A of a blade arm 797. A tab 779 is fixed to the branch 797A adjacent the pivot 799 and extends downwardly in a direction normal to the branch 797A. The tab 779 contacts a shaft-end 787A of the drive shaft 787 opposite the offset handle 794 and extending beyond the carrier 789. The branch 797A extends outwardly from the pivot 799 in a normal direction to the carrier arm 790 and couples to the blade arm 797 at an end opposite the carrier arm 790. The blade arm 797 is generally arcuately shaped and extends downwardly from the branch 797A to connect to a superior blade 796 with a tissue retractor 798 extending therefrom. Because the pivot 799 is located above the superior blade 796, a lifting force is exerted on the superior blade 796 and ribs as a spreading force from the inferior blade 783 is transmitted to the superior blade 796 through the pivot 799.

Rotation of the offset handle 794, while holding the spreader handle 793 stationary, will thread the drive screw 787 through both the spreader handle 793 and the carrier 789, and thereby cause the drive screw 787 and carrier 789 to traverse the drive base 781 as well as causing the carrier 789 to traverse the drive screw 787 in the same direction. As a result, the carrier 789 traverses the drive base 781 at approximately two-times the speed that the carrier 789 traverses the drive screw 787 and thus, the length of the shaft-end 787A extending beyond the carrier 789 will increase or decrease at approximately one-half the speed at which the carrier 789 traverses the drive base 781. Therefore, as the offset handle 794 is rotated in a direction to spread the ribs, the ribs will be raised at a rate slower than they are spread as the superior blade 796 naturally rotates about the pivot 799 as the length of the shaft-end 787A extending beyond the carrier 789 decreases. Similarly, as the offset handle 794 is rotated in a direction to lower the offset ribs, the length of the shaft-end 787A will increase, at a rate slower than the rate at which the carrier 789 traverses the drive base 781. As the length of the shaft end 787A increases, it forces the tab 779, and thus the superior blade 797, to rotate in the counterclockwise direction around the pivot 799, and thereby further lowers the ribs. Because the carrier 789 traverses the drive base 781 at a faster rate than the shaft-end 787A increases, the distance between the blades 783 and 796 along the drive base 781 tends to decrease as the ribs are lowered;"

page 70, line 3-page 71, line 10: "Turning to Figure 40, a seventeenth embodiment of the access platform 800 comprises a spreader housing 801 which includes a drive mechanism housed therein (not shown) and a drive slot 803 cut into the spreader housing 801. A spreader lever 802 is mounted on the top of the spreader housing 801 and is operably connected to the drive mechanism housed therein. An inferior blade 805 having a tissue retractor 804 extending therefrom, is interconnected to the drive mechanism via a blade arm 806. The blade arm 806 extends outwardly from the spreader housing 801 in a generally normal direction.

A pad arm 817 connects at one end, or is formed integrally therewith, to the spreader housing 801 and extends outwardly therefrom. A sternal pad 816 is integrally formed on the pad arm 817 at an end opposite the housing 801. The pad arm 817 is generally arcuate to conform to an extended rib cage due to the offset of the ribs.

A superior blade 820 having a tissue retractor 821 extending therefrom, is connected to the bottom end of a generally arcuately shaped blade arm 818. The top end of the blade arm 818 is pivotally mounted on an offset stanchion 815 that extends upwardly from the pad arm 817. A compression member 813 is pivotally connected to the top of the stanchion 815 at pivot 814 and extends inwardly from the stanchion 815 toward the lever 802 on the spreader housing 801. An offset screw 811 having a handle 812 attached to its top end, is threaded through the compression member 813 at an end opposite the pivot 814 and is rotatably captured by a bushing assembly 808 rotatably coupled to a mount 807 that extends upwardly from the spreader housing 801. A counter-lift tab 809 extends inwardly from the blade arm 818 adjacent the stanchion 815. The lift tab 809 is operably connected to the compression member 813 through an offset spring 810 mounted therebetween;"

<p>107. The retractor according to claim 106 in which said second blade is pivotally attached to said spreader member, and</p>	<p>See, e.g., figures 31-32, 33-34, 39, 40</p> <p>See, e.g., page 48, lines 1-11: "Turning to Figure 28, an eleventh embodiment of the access platform 651 comprises a spreader housing 602 that includes a drive mechanism therein (not shown) and a drive slot 608 formed therein. A spreader lever 604 is mounted on top of the spreader housing 602 and is operably connected to the drive mechanism housed therein. An inferior blade 650 is interconnected to the drive mechanism via a blade arm 640 which extends outwardly to the inferior blade 650 from the spreader housing 602 in a direction generally normal to the housing 602. A tissue retractor 670 is attached to the blade 650 to assist in tissue retraction;"</p> <p>page 51, line 10-page 52, line 20: " Turning to Figure 30, a thirteenth embodiment of the access platform 655 of the present invention comprises a generally elongated drive base 601 having a blade arm 640 and a pad arm 683 extending therefrom. The blade arm 640 extends in a generally normal direction from the drive base 601, while the pad arm 683, which is generally arcuately shaped, extends longitudinally and downwardly from the drive base 601. The pad arm 683 terminates in a sternal pad 681. A threaded shaft carrier 607 extends upwardly from the drive base 601 adjacent the blade arm 640. An inferior blade 650 having a tissue retractor 670 extending therefrom attaches to the blade arm 640. In a preferred construction, the inferior blade 650, tissue retractor 670, blade arm 640, threaded shaft carrier 607, drive base 601, pad arm 683, and sternal pad 681 are formed from one-piece construction.</p> <p>A hollow threaded shaft 603 is threaded through the shaft carrier 607 and extends along the drive base 601 to rotatably attach to a hollow drive block 609. A spreader handle 605 is attached to the shaft 603 at an end opposite the drive block 609. A worm gear 697 positioned in the drive block 609, is fixed to the end of a shaft 696 that passes through the hollow threaded shaft 603 and attaches to an offset handle 695 beyond the spreader handle 605. The worm gear 697 is operably connected to an arcuate worm gear rack 698 that is positioned within the drive block 609 and connected to a branch 643 of a blade arm 642. The branch 643 of the blade arm 642 extends from the blade arm 642 in a normal direction and is pivotally mounted to the hollow drive block 609. The blade arm 642 extends downwardly from the branch 643 and attaches to a superior blade 652 with a tissue retractor 672 extending therefrom. A follower 619 extends downwardly from the base of the hollow drive block 609 and is received in a elongated drive slot 611 in the drive base 601. As the drive block 609 is transversely driven along the base 601 by the threaded shaft 603, the follower 609 slidably follows the drive slot 611 in the drive base 601;"</p>
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page 54, line 16-page 55, line 19: "Referring to Figures 31 and 32, a fourteenth embodiment of the access platform 610 of the present invention comprises a spreader component 612 that includes a rack 613, a spreader base 614 attached to one end of the rack 613 and a pinion housing 620 slidably received over the rack 613. A pinion 621 that is driven by a lever 622 is rotatably retained in the pinion housing 620 and operably connected to the rack 613.

A fixed pivot 616 having a socket 618 formed therein, extends from the spreader base 614. A fixed pivot lock 615 with a lock screw 617 is fixedly connected to the fixed pivot 616. A moveable pivot 624 having a socket 625 formed therein, extends from the housing 620. Rotatably and releasably received in and extending from the sockets 618 and 625 are stem portions 644 and 646 of a pair of blade arms 640 and 642, respectively. The stem 644 that is received in the socket 618 of the fixed pivot 616 includes a stop 645 formed on its exterior to abut the fixed pivot lock 615 and stop the travel of the stem 644. Branch portions 641 and 643 of the blade arms 640 and 642 extend downwardly from the stem portions 644 and 646 and attach to inferior and superior blades 650 and 652, respectively. The superior blade 652 which is advantageously located below and interconnected to the moveable pivot 624, comprises a recessed throat 654 to capture a rib adjacent to an incision in the patient's chest cavity and a pair of elongated vanes 656 and 657 used to offset a plurality of the patient's ribs. The inferior blade 650 which is interconnected to the fixed pivot 616 comprises a recessed throat 653 used to capture a rib adjacent to an incision in the patient's chest cavity;"

page 56, lines 3-13: " The branch portion 643 of the blade arm 642 that is interconnected to the moveable pivot 624 extends higher vertically than the branch portion 641 of the blade arm 640 that is interconnected to the fixed pivot 616 when the blades 650 and 652 are substantially level (see Figure 29). This construction tends to increase the moment about the moveable pivot 624 caused by the offset of the movable pivot from the center-of-effort of the spreading force at the blades 650 and 652. Because the movable pivot 624 is located above the superior blade 652, a lifting force is naturally exerted on the superior blade 652 and ribs as spreading occurs;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 64, line 5-page 67, line 5: " Referring to Figure 39, a sixteenth embodiment of an access platform 780 comprises a generally elongated drive base 781 having a blade arm 782 extended generally in a normal direction from the drive base 781. A generally arcuate pad arm 786 extends generally longitudinally and downwardly from the drive base 781 and terminates at a sternal pad 785. A bearing support 791 extends upwardly from the drive base 781 adjacent the blade arm 782. An inferior blade 783 having a tissue retractor 784 extending therefrom attaches to the end of the inferior blade arm 782. In a preferred construction, the inferior blade 781, tissue retractor 784, blade arm 782, bearing support 791, drive base 781, pad arm 786 and sternal pad 785 are formed from one-piece construction.

A bearing 792 is mounted to the bearing support 791 and has a spreader handle 793 operably coupled thereto. A drive screw 787 having an offset handle 794 with a lever 795 attached to its first end, is threaded through the spreader handle 793 and freely passes through the bearing 792 and bearing support 791. The drive screw 787 extends longitudinally along the drive base 781 and is threaded through a carrier mount 789. The spreader handle 793 and the carrier mount 789 include oppositely wound threads. Rotation of the spreader handle 793 transversely drives the drive screw 787 and the carrier mount 789 mounted thereon along the drive base 781 and, thus, spreads or closes the blades 783 and 796. The carrier mount 789 includes a follower extending downwardly from its base that inserts into a drive slot 788 in the base 781. As the carrier mount 789 is translated across the drive base 781, the follower slides along the drive slot 788.

Extending upwardly and longitudinally outwardly in a direction away from the spreader handle 793, a carrier arm 790 extends from the carrier 789. At an end opposite the carrier mount 789, the carrier arm 790 pivotally captures at a pivot 799 a branch 797A of a blade arm 797. A tab 779 is fixed to the branch 797A adjacent the pivot 799 and extends downwardly in a direction normal to the branch 797A. The tab 779 contacts a shaft-end 787A of the drive shaft 787 opposite the offset handle 794 and extending beyond the carrier 789. The branch 797A extends outwardly from the pivot 799 in a normal direction to the carrier arm 790 and couples to the blade arm 797 at an end opposite the carrier arm 790. The blade arm 797 is generally arcuately shaped and extends downwardly from the branch 797A to connect to a superior blade 796 with a tissue retractor 798 extending therefrom. Because the pivot 799 is located above the superior blade 796, a lifting force is exerted on the superior blade 796 and ribs as a spreading force from the inferior blade 783 is transmitted to the superior blade 796 through the pivot 799.

Rotation of the offset handle 794, while holding the spreader handle 793 stationary, will thread the drive screw 787 through both the spreader handle 793 and the carrier 789, and thereby cause the drive screw 787 and carrier 789 to traverse the drive base 781 as well as causing the carrier 789 to traverse the drive screw 787 in the same direction. As a result, the carrier 789 traverses the drive base 781 at approximately two-times the speed that the carrier 789 traverses the drive screw 787 and thus, the length of the shaft-end 787A extending beyond the carrier 789 will increase or decrease at approximately one-half the speed at which the carrier 789 traverses the drive base 781. Therefore, as the offset handle 794 is rotated in a direction to spread the ribs, the ribs will be raised at a rate slower than they are spread as the superior blade 796 naturally rotates about the pivot 799 as the length of the shaft-end 787A extending beyond the carrier 789 decreases. Similarly, as the offset handle 794 is rotated in a direction to lower the offset ribs, the length of the shaft-end 787A will increase, at a rate slower than the rate at which the carrier 789 traverses the drive base 781. As the length of the shaft end 787A increases, it forces the tab 779, and thus the superior blade 797, to rotate in the counterclockwise direction around the pivot 799, and thereby further lowers the ribs. Because the carrier 789 traverses the drive base 781 at a faster rate than the shaft-end 787A increases, the distance between the blades 783 and 796 along the drive base 781 tends to decrease as the ribs are lowered;"

page 70, line 3-page 71, line 10: "Turning to Figure 40, a seventeenth embodiment of the access platform 800 comprises a spreader housing 801 which includes a drive mechanism housed therein (not shown) and a drive slot 803 cut into the spreader housing 801. A spreader lever 802 is mounted on the top of the spreader housing 801 and is operably connected to the drive mechanism housed therein. An inferior blade 805 having a tissue retractor 804 extending therefrom, is interconnected to the drive mechanism via a blade arm 806. The blade arm 806 extends outwardly from the spreader housing 801 in a generally normal direction.

A pad arm 817 connects at one end, or is formed integrally therewith, to the spreader housing 801 and extends outwardly therefrom. A sternal pad 816 is integrally formed on the pad arm 817 at an end opposite the housing 801. The pad arm 817 is generally arcuate to conform to an extended rib cage due to the offset of the ribs.

A superior blade 820 having a tissue retractor 821 extending therefrom, is connected to the bottom end of a generally arcuately shaped blade arm 818. The top end of the blade arm 818 is pivotally mounted on an offset stanchion 815 that extends upwardly from the pad arm 817. A compression member 813 is pivotally connected to the top of the stanchion 815 at pivot 814 and extends inwardly from the stanchion 815 toward the lever 802 on the spreader housing 801. An offset screw 811 having a handle 812 attached to its top end, is threaded through the compression member 813 at an end opposite the pivot 814 and is rotatably captured by a bushing assembly 808 rotatably coupled to a mount 807 that extends upwardly from the spreader housing 801. A counter-lift tab 809 extends inwardly from the blade arm 818 adjacent the stanchion 815. The lift tab 809 is operably connected to the compression member 813 through an offset spring 810 mounted therebetween;"

<p>an angle adjusting means for adjusting the angle of retraction of said second blade; whereby said blade lifts an upper portion of the ribcage to provide improved access and visibility of the intermammary artery.</p>	<p>See, e.g., page 48, lines 1-11: "Turning to Figure 28, an eleventh embodiment of the access platform 651 comprises a spreader housing 602 that includes a drive mechanism therein (not shown) and a drive slot 608 formed therein. A spreader lever 604 is mounted on top of the spreader housing 602 and is operably connected to the drive mechanism housed therein. An inferior blade 650 is interconnected to the drive mechanism via a blade arm 640 which extends outwardly to the inferior blade 650 from the spreader housing 602 in a direction generally normal to the housing 602. A tissue retractor 670 is attached to the blade 650 to assist in tissue retraction;"</p> <p>page 51, line 10-page 52, line 20: " Turning to Figure 30, a thirteenth embodiment of the access platform 655 of the present invention comprises a generally elongated drive base 601 having a blade arm 640 and a pad arm 683 extending therefrom. The blade arm 640 extends in a generally normal direction from the drive base 601, while the pad arm 683, which is generally arcuately shaped, extends longitudinally and downwardly from the drive base 601. The pad arm 683 terminates in a sternal pad 681. A threaded shaft carrier 607 extends upwardly from the drive base 601 adjacent the blade arm 640. An inferior blade 650 having a tissue retractor 670 extending therefrom attaches to the blade arm 640. In a preferred construction, the inferior blade 650, tissue retractor 670, blade arm 640, threaded shaft carrier 607, drive base 601, pad arm 683, and sternal pad 681 are formed from one-piece construction.</p> <p>A hollow threaded shaft 603 is threaded through the shaft carrier 607 and extends along the drive base 601 to rotatably attach to a hollow drive block 609. A spreader handle 605 is attached to the shaft 603 at an end opposite the drive block 609. A worm gear 697 positioned in the drive block 609, is fixed to the end of a shaft 696 that passes through the hollow threaded shaft 603 and attaches to an offset handle 695 beyond the spreader handle 605. The worm gear 697 is operably connected to an arcuate worm gear rack 698 that is positioned within the drive block 609 and connected to a branch 643 of a blade arm 642. The branch 643 of the blade arm 642 extends from the blade arm 642 in a normal direction and is pivotally mounted to the hollow drive block 609. The blade arm 642 extends downwardly from the branch 643 and attaches to a superior blade 652 with a tissue retractor 672 extending therefrom. A follower 619 extends downwardly from the base of the hollow drive block 609 and is received in a elongated drive slot 611 in the drive base 601. As the drive block 609 is transversely driven along the base 601 by the threaded shaft 603, the follower 609 slidably follows the drive slot 611 in the drive base 601;"</p>
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page 57, lines 4-22: "The offset link 632 comprises a substantially "L" shaped base 631 that extends from the pinion housing 620 at one end and terminates at the other end in a pair of parallel spaced and arcuate shaped fingers 633 and 634. A bushing 635 having a hole tapped through its center perpendicular to the bushing's 635 longitudinal axis, is rotatably captured by the fingers 633 and 634. An adjustable offset drive screw 636 is threaded through the hole in the bushing 635 and is operably connected to the shoe arm 682.

The adjustable offset drive screw 636 comprises a handle 637 attached to the top end of a jack screw 638. The base of the jack screw 638 is formed as a hemisphere 639. The hemisphere 639 operably couples with a hemispherical recess 686 cut into a boss 684 that extends outwardly from the shoe arm 682. The boss 684 is tilted upwardly at an angle Θ relative to the longitudinal axis of the shoe arm 682. This construction ensures that the hemisphere 639 will maintain contact with the boss 684 during operation as the jack screw 638 forces the shoe arm 682 and shoe 680 to rotate downwardly in a clockwise direction;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 64, line 5-page 67, line 5: " Referring to Figure 39, a sixteenth embodiment of an access platform 780 comprises a generally elongated drive base 781 having a blade arm 782 extended generally in a normal direction from the drive base 781. A generally arcuate pad arm 786 extends generally longitudinally and downwardly from the drive base 781 and terminates at a sternal pad 785. A bearing support 791 extends upwardly from the drive base 781 adjacent the blade arm 782. An inferior blade 783 having a tissue retractor 784 extending therefrom attaches to the end of the inferior blade arm 782. In a preferred construction, the inferior blade 781, tissue retractor 784, blade arm 782, bearing support 791, drive base 781, pad arm 786 and sternal pad 785 are formed from one-piece construction.

A bearing 792 is mounted to the bearing support 791 and has a spreader handle 793 operably coupled thereto. A drive screw 787 having an offset handle 794 with a lever 795 attached to its first end, is threaded through the spreader handle 793 and freely passes through the bearing 792 and bearing support 791. The drive screw 787 extends longitudinally along the drive base 781 and is threaded through a carrier mount 789. The spreader handle 793 and the carrier mount 789 include oppositely wound threads. Rotation of the spreader handle 793 transversely drives the drive screw 787 and the carrier mount 789 mounted thereon along the drive base 781 and, thus, spreads or closes the blades 783 and 796. The carrier mount 789 includes a follower extending downwardly from its base that inserts into a drive slot 788 in the base 781. As the carrier mount 789 is translated across the drive base 781, the follower slides along the drive slot 788.

Extending upwardly and longitudinally outwardly in a direction away from the spreader handle 793, a carrier arm 790 extends from the carrier 789. At an end opposite the carrier mount 789, the carrier arm 790 pivotally captures at a pivot 799 a branch 797A of a blade arm 797. A tab 779 is fixed to the branch 797A adjacent the pivot 799 and extends downwardly in a direction normal to the branch 797A. The tab 779 contacts a shaft-end 787A of the drive shaft 787 opposite the offset handle 794 and extending beyond the carrier 789. The branch 797A extends outwardly from the pivot 799 in a normal direction to the carrier arm 790 and couples to the blade arm 797 at an end opposite the carrier arm 790. The blade arm 797 is generally arcuately shaped and extends downwardly from the branch 797A to connect to a superior blade 796 with a tissue retractor 798 extending therefrom. Because the pivot 799 is located above the superior blade 796, a lifting force is exerted on the superior blade 796 and ribs as a spreading force from the inferior blade 783 is transmitted to the superior blade 796 through the pivot 799.

Rotation of the offset handle 794, while holding the spreader handle 793 stationary, will thread the drive screw 787 through both the spreader handle 793 and the carrier 789, and thereby cause the drive screw 787 and carrier 789 to traverse the drive base 781 as well as causing the carrier 789 to traverse the drive screw 787 in the same direction. As a result, the carrier 789 traverses the drive base 781 at approximately two-times the speed that the carrier 789 traverses the drive screw 787 and thus, the length of the shaft-end 787A extending beyond the carrier 789 will increase or decrease at approximately one-half the speed at which the carrier 789 traverses the drive base 781. Therefore, as the offset handle 794 is rotated in a direction to spread the ribs, the ribs will be raised at a rate slower than they are spread as the superior blade 796 naturally rotates about the pivot 799 as the length of the shaft-end 787A extending beyond the carrier 789 decreases. Similarly, as the offset handle 794 is rotated in a direction to lower the offset ribs, the length of the shaft-end 787A will increase, at a rate slower than the rate at which the carrier 789 traverses the drive base 781. As the length of the shaft end 787A increases, it forces the tab 779, and thus the superior blade 797, to rotate in the counterclockwise direction around the pivot 799, and thereby further lowers the ribs. Because the carrier 789 traverses the drive base 781 at a faster rate than the shaft-end 787A increases, the distance between the blades 783 and 796 along the drive base 781 tends to decrease as the ribs are lowered;"

page 70, line 3-page 71, line 10: "Turning to Figure 40, a seventeenth embodiment of the access platform 800 comprises a spreader housing 801 which includes a drive mechanism housed therein (not shown) and a drive slot 803 cut into the spreader housing 801. A spreader lever 802 is mounted on the top of the spreader housing 801 and is operably connected to the drive mechanism housed therein. An inferior blade 805 having a tissue retractor 804 extending therefrom, is interconnected to the drive mechanism via a blade arm 806. The blade arm 806 extends outwardly from the spreader housing 801 in a generally normal direction.

A pad arm 817 connects at one end, or is formed integrally therewith, to the spreader housing 801 and extends outwardly therefrom. A sternal pad 816 is integrally formed on the pad arm 817 at an end opposite the housing 801. The pad arm 817 is generally arcuate to conform to an extended rib cage due to the offset of the ribs.

A superior blade 820 having a tissue retractor 821 extending therefrom, is connected to the bottom end of a generally arcuately shaped blade arm 818. The top end of the blade arm 818 is pivotally mounted on an offset stanchion 815 that extends upwardly from the pad arm 817. A compression member 813 is pivotally connected to the top of the stanchion 815 at pivot 814 and extends inwardly from the stanchion 815 toward the lever 802 on the spreader housing 801. An offset screw 811 having a handle 812 attached to its top end, is threaded through the compression member 813 at an end opposite the pivot 814 and is rotatably captured by a bushing assembly 808 rotatably coupled to a mount 807 that extends upwardly from the spreader housing 801. A counter-lift tab 809 extends inwardly from the blade arm 818 adjacent the stanchion 815. The lift tab 809 is operably connected to the compression member 813 through an offset spring 810 mounted therebetween;"

<p>108. The retractor according to claim 106 in which said second blade has a curved throat portion and a elongated vane portion; said vane portion being tapered toward a tip.</p>	<p>See, e.g., page 21, lines 6-12: " Referring to Figure 2, the blades 50 and 51 preferably include elongated vanes 52 and 53, which slide beneath a plurality of the patient's ribs, and recessed arcuate throats 54 and 55 that receive the patient's ribs that are adjacent to the chest incision. The benefits of the recessed throats 54 and 55 and the elongated vanes 52 and 53 will be discussed below with regard to the operation of the access platform 10;"</p>
	<p>page 30, line 16-page 31, line 2: "The elongated vane construction of the blades 50 and 51 advantageously enables the access platform 10 to vertically raise a plurality of the patient's ribs R to cause a greater "tunnel" effect under a patient's rib cage and, thus, increases the surgeon's working area and visual access to the IMA. The recessed throat construction of the blades 50 and 51 advantageously enables the access platform 10 to vertically displace the opposite rib that is adjacent to the chest incision downwardly to further increase the surgeon's visual access. This combined motion helps to create an optimum tunnel;"</p>
	<p>page 55 lines 11-19: "The superior blade 652 which is advantageously located below and interconnected to the moveable pivot 624, comprises a recessed throat 654 to capture a rib adjacent to an incision in the patient's chest cavity and a pair of elongated vanes 656 and 657 used to offset a plurality of the patient's ribs. The inferior blade 650 which is interconnected to the fixed pivot 616 comprises a recessed throat 653 used to capture a rib adjacent to an incision in the patient's chest cavity;"</p>
	<p>page 87, line 19-page 88, line 18: "Referring to Figures 71-74, the blades utilized with the access platform embodiments described herein are preferably interchangeable from a spreader-type blade to an offsetting-type blade. In Figure 71, an elongated vane member 561 folds like a pocket knife into a slot 562 formed in a spreader blade 560. In Figure 72, an elongated member 561 is extensible and flexible. The elongated member 561 can be hidden substantially within a slot 562 formed in a spreader blade 560, or extended out the top or bottom of the slot 562 for rib lifting or tissue retraction. The elongated member 561 is flexible in concavity but is prevented by straps or hinges from flexing in the opposite direction past straight.</p> <p>In Figures 73 and 74, an offset type blade 565 is shown to comprise an elongated vane 563 and a recess in the throat area 568 sized to receive a spreader blade 564. A groove 567 is cut into the offset blade 565 at one end of the recess and a tongue 570 extending from the offset type blade 565 is formed at the other end of the recess. A tongue 569 extending from the lower portion of the spreader blade 564 mates with the groove 567 in the offset blade 565. A groove 566 formed in the top part of the spreader blade 564 mates with the tongue 570 of the offset-type blade 565. This tongue and groove assembly detachably couples the spreader and offset-type blades together to interchange a spreader blade 564 into an offset-type blade 565;"</p>

<p>109. . The retractor according to claim 106 in which said offset member comprises an adjustable support arm attached to said spreader member for raising or lowering said second blade relative to said first blade to raise an upper portion of the ribcage to provide improved access and visibility of said intermammary artery.</p>	<p>See, e.g., page 22, lines 3-24: "The support pads 80 and 81 are connected to adjustable arms 86 and 87 by swivel connectors 82 and 83 that are preferably constructed as ball and socket type connectors 84 and 85. The adjustable arms 86 and 87 preferably include external shafts 88 and 89 slidably received over and operably connected to internal shafts 98 and 99. The external shafts 88 and 89 are preferably operably connected to the internal shafts 98 and 99 via a ratchet lever mechanism (not shown). The internal shafts 98 and 99 of the adjustable arms 86 and 87 are further connected to lock positioners 90 and 91. The lock positioners 90 and 91, which are attached to the torque bases 32 and 33, comprise a ratchet or a wrap spring type mechanism (not shown) or, alternatively, comprise opposing face gears 94 and 96, 95 and 97. Tabs 92 and 93 rotate and cooperate with cammed or serrated surfaces 36 and 37 on the outer face of the outer face gears 94 and 95 to engage and disengage the opposing face gears 94 and 96, 95 and 97. Thus, when the tabs 92 and 93 are rotated to disengage the face gears 94 and 96, 95 and 97, the support pads 80 and 81 can be rotated to a desired position. Once the support pads 80 and 81 are in position, the tabs 92 and 93 are rotated to engage the face gears 94 and 96, 95 and 97 and, thus, lock the support pads 80 and 81 in place;"</p> <p>page 33, line 15- page 34, line 5: " Preferably, one end of the horizontally disposed rack 120 is connected to a slide 172 of a lock positioner 171. The slide 172 is slidably received over a vertically disposed support pad stanchion 167. The stanchion 167 has ratchet gear teeth 173 formed thereon which cooperate with a pawl 174 attached to the slide 172 to adjustably position the support pad 161. The support pad 161 is adjustably connected to the stanchion 167 by a swivel connector 163.</p> <p>The opposing end of the horizontally disposed rack 120 is preferably connected to a support pad link 176 via a lockable ball and socket joint 177. The support pad link 176 is further connected to a second support pad link 175 via a hinge joint 178. This link and joint assembly allows for the multiple positioning of the support pad 160. The support pad 160 is further connected to the support pad link 175 via a swivel connector 162;"</p>
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page 45, line 3-page 46, line 21: " Turning to Figure 26, a ninth embodiment of the access platform 410 of the present invention is shown. The access platform 410 mounts to the table or rail via slides 438 and 440 that are locked in place by positioners 450 and 452. The slides 438 and 440 rotatably retain pinions 442 and 444 driven by levers 446 and 448 and slidably receive stanchion racks 430 and 432. The stanchion racks 430 and 432 include rack gears 434 and 436 that operably couple with pinions 442 and 444. The levers 446 and 448 are rotated to drive the pinions 442 and 444 along rack gears 434 and 436 to adjust the height of the stanchion racks 430 and 432 relative to the table or patient, or to vertically offset blades 470 and 472 relative to one another.

A pinion housing 422 is slidably attached to the stanchion rack 432 towards its upper end. A rack 420 is attached at one end to stanchion rack 430 and is slidably received in the pinion housing 422. A pinion 424 driven by a lever 426 is rotatably retained in the pinion housing 422 and operably connected to the rack 420. The lever 426 is rotated to drive the pinion 424 along the rack 420 to spread apart the stanchion racks 430 and 432 and effectively a patient's ribs.

Torsional members 460 and 462 are attached to the top of the stanchion racks 430 and 432. Blade arms 474 and 476 extend outwardly from torsional members and attach to the blades 470 and 472. The torsional members comprise inner hubs 461 and 465 rotatably received in and operably connected to outer hubs 463 and 467. Locking levers 464 and 466 lock the inner hubs 461 and 465 in place relative to the outer hubs 463 and 467.

In operation, the access platform 410 is positioned such that the blades 470 and 472 can be inserted into an incision in a patient's chest and then attached to the blade arms 474 and 476. Once the blades 470 and 472 are positioned in the incision and attached to the blade arms 474 and 476, the lever 426 is rotated to spread the blades 470 and 472 and the patient's ribs apart. The blades 470 and 472 can be effectively offset by rotating the inner hubs 461 and 465 relative to the outer hubs 463 and 467. While the blades 470 and 472 are rotated, the stanchion racks 430 and 432 can be raised or lowered by rotating levers 486 and 488 to drive pinions 442 and 444. By raising or lowering the stanchion racks 430 and 432, the blades 470 and 472 can be effectively raised or lowered relative to one another to further offset the blades 470 and 472 relative to one another. A wrench 468 is utilized to rotate the inner hubs 461 and 465 relative to the outer hubs 463 and 467;"

page 56, line 3-page 57, line 22: " The branch portion 643 of the blade arm 642 that is interconnected to the moveable pivot 624 extends higher vertically than the branch portion 641 of the blade arm 640 that is interconnected to the fixed pivot 616 when the blades 650 and 652 are substantially level (see Figure 29). This construction tends to increase the moment about the moveable pivot 624 caused by the offset of the movable pivot from the center-of-effort of the spreading force at the blades 650 and 652. Because the movable pivot 624 is located above the superior blade 652, a lifting force is naturally exerted on the superior blade 652 and ribs as spreading occurs.

To add additional offset of the superior blade 652 once the blades 650 and 652 are separated and offset, a vertical displacement component 630 is included on the access platform 610. The vertical displacement component 630 comprises a rib compression shoe 680, a substantially "S" shaped shoe arm 682 connected to the shoe 680 at one end and pivotally connected to the stem 646 of the blade arm 642 at the other end, and an adjustable offset link 632 connected to the pinion housing 620 and operably connected to the shoe arm 682 and shoe 680;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 64, line 5-page 67, line 5: " Referring to Figure 39, a sixteenth embodiment of an access platform 780 comprises a generally elongated drive base 781 having a blade arm 782 extended generally in a normal direction from the drive base 781. A generally arcuate pad arm 786 extends generally longitudinally and downwardly from the drive base 781 and terminates at a sternal pad 785. A bearing support 791 extends upwardly from the drive base 781 adjacent the blade arm 782. An inferior blade 783 having a tissue retractor 784 extending therefrom attaches to the end of the inferior blade arm 782. In a preferred construction, the inferior blade 781, tissue retractor 784, blade arm 782, bearing support 791, drive base 781, pad arm 786 and sternal pad 785 are formed from one-piece construction.

A bearing 792 is mounted to the bearing support 791 and has a spreader handle 793 operably coupled thereto. A drive screw 787 having an offset handle 794 with a lever 795 attached to its first end, is threaded through the spreader handle 793 and freely passes through the bearing 792 and bearing support 791. The drive screw 787 extends longitudinally along the drive base 781 and is threaded through a carrier mount 789. The spreader handle 793 and the carrier mount 789 include oppositely wound threads. Rotation of the spreader handle 793 transversely drives the drive screw 787 and the carrier mount 789 mounted thereon along the drive base 781 and, thus, spreads or closes the blades 783 and 796. The carrier mount 789 includes a follower extending downwardly from its base that inserts into a drive slot 788 in the base 781. As the carrier mount 789 is translated across the drive base 781, the follower slides along the drive slot 788.

Extending upwardly and longitudinally outwardly in a direction away from the spreader handle 793, a carrier arm 790 extends from the carrier 789. At an end opposite the carrier mount 789, the carrier arm 790 pivotally captures at a pivot 799 a branch 797A of a blade arm 797. A tab 779 is fixed to the branch 797A adjacent the pivot 799 and extends downwardly in a direction normal to the branch 797A. The tab 779 contacts a shaft-end 787A of the drive shaft 787 opposite the offset handle 794 and extending beyond the carrier 789. The branch 797A extends outwardly from the pivot 799 in a normal direction to the carrier arm 790 and couples to the blade arm 797 at an end opposite the carrier arm 790. The blade arm 797 is generally arcuately shaped and extends downwardly from the branch 797A to connect to a superior blade 796 with a tissue retractor 798 extending therefrom. Because the pivot 799 is located above the superior blade 796, a lifting force is exerted on the superior blade 796 and ribs as a spreading force from the inferior blade 783 is transmitted to the superior blade 796 through the pivot 799.

Rotation of the offset handle 794, while holding the spreader handle 793 stationary, will thread the drive screw 787 through both the spreader handle 793 and the carrier 789, and thereby cause the drive screw 787 and carrier 789 to traverse the drive base 781 as well as causing the carrier 789 to traverse the drive screw 787 in the same direction. As a result, the carrier 789 traverses the drive base 781 at approximately two-times the speed that the carrier 789 traverses the drive screw 787 and thus, the length of the shaft-end 787A extending beyond the carrier 789 will increase or decrease at approximately one-half the speed at which the carrier 789 traverses the drive base 781. Therefore, as the offset handle 794 is rotated in a direction to spread the ribs, the ribs will be raised at a rate slower than they are spread as the superior blade 796 naturally rotates about the pivot 799 as the length of the shaft-end 787A extending beyond the carrier 789 decreases. Similarly, as the offset handle 794 is rotated in a direction to lower the offset ribs, the length of the shaft-end 787A will increase, at a rate slower than the rate at which the carrier 789 traverses the drive base 781. As the length of the shaft end 787A increases, it forces the tab 779, and thus the superior blade 797, to rotate in the counterclockwise direction around the pivot 799, and thereby further lowers the ribs. Because the carrier 789 traverses the drive base 781 at a faster rate than the shaft-end 787A increases, the distance between the blades 783 and 796 along the drive base 781 tends to decrease as the ribs are lowered;"

110. The retractor according to claim 109 including a footpad on an end of said support arm.

See, e.g., page 22, lines 3-24: "The support pads 80 and 81 are connected to adjustable arms 86 and 87 by swivel connectors 82 and 83 that are preferably constructed as ball and socket type connectors 84 and 85. The adjustable arms 86 and 87 preferably include external shafts 88 and 89 slidably received over and operably connected to internal shafts 98 and 99. The external shafts 88 and 89 are preferably operably connected to the internal shafts 98 and 99 via a ratchet lever mechanism (not shown). The internal shafts 98 and 99 of the adjustable arms 86 and 87 are further connected to lock positioners 90 and 91. The lock positioners 90 and 91, which are attached to the torque bases 32 and 33, comprise a ratchet or a wrap spring type mechanism (not shown) or, alternatively, comprise opposing face gears 94 and 96, 95 and 97. Tabs 92 and 93 rotate and cooperate with cammed or serrated surfaces 36 and 37 on the outer face of the outer face gears 94 and 95 to engage and disengage the opposing face gears 94 and 96, 95 and 97. Thus, when the tabs 92 and 93 are rotated to disengage the face gears 94 and 96, 95 and 97, the support pads 80 and 81 can be rotated to a desired position. Once the support pads 80 and 81 are in position, the tabs 92 and 93 are rotated to engage the face gears 94 and 96, 95 and 97 and, thus, lock the support pads 80 and 81 in place;"

page 56, line 3-page 57, line 22: " The branch portion 643 of the blade arm 642 that is interconnected to the moveable pivot 624 extends higher vertically than the branch portion 641 of the blade arm 640 that is interconnected to the fixed pivot 616 when the blades 650 and 652 are substantially level (see Figure 29). This construction tends to increase the moment about the moveable pivot 624 caused by the offset of the movable pivot from the center-of-effort of the spreading force at the blades 650 and 652. Because the movable pivot 624 is located above the superior blade 652, a lifting force is naturally exerted on the superior blade 652 and ribs as spreading occurs.

To add additional offset of the superior blade 652 once the blades 650 and 652 are separated and offset, a vertical displacement component 630 is included on the access platform 610. The vertical displacement component 630 comprises a rib compression shoe 680, a substantially "S" shaped shoe arm 682 connected to the shoe 680 at one end and pivotally connected to the stem 646 of the blade arm 642 at the other end, and an adjustable offset link 632 connected to the pinion housing 620 and operably connected to the shoe arm 682 and shoe 680;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 64, line 5-page 67, line 5: " Referring to Figure 39, a sixteenth embodiment of an access platform 780 comprises a generally elongated drive base 781 having a blade arm 782 extended generally in a normal direction from the drive base 781. A generally arcuate pad arm 786 extends generally longitudinally and downwardly from the drive base 781 and terminates at a sternal pad 785. A bearing support 791 extends upwardly from the drive base 781 adjacent the blade arm 782. An inferior blade 783 having a tissue retractor 784 extending therefrom attaches to the end of the inferior blade arm 782. In a preferred construction, the inferior blade 781, tissue retractor 784, blade arm 782, bearing support 791, drive base 781, pad arm 786 and sternal pad 785 are formed from one-piece construction.

A bearing 792 is mounted to the bearing support 791 and has a spreader handle 793 operably coupled thereto. A drive screw 787 having an offset handle 794 with a lever 795 attached to its first end, is threaded through the spreader handle 793 and freely passes through the bearing 792 and bearing support 791. The drive screw 787 extends longitudinally along the drive base 781 and is threaded through a carrier mount 789. The spreader handle 793 and the carrier mount 789 include oppositely wound threads. Rotation of the spreader handle 793 transversely drives the drive screw 787 and the carrier mount 789 mounted thereon along the drive base 781 and, thus, spreads or closes the blades 783 and 796. The carrier mount 789 includes a follower extending downwardly from its base that inserts into a drive slot 788 in the base 781. As the carrier mount 789 is translated across the drive base 781, the follower slides along the drive slot 788.

Extending upwardly and longitudinally outwardly in a direction away from the spreader handle 793, a carrier arm 790 extends from the carrier 789. At an end opposite the carrier mount 789, the carrier arm 790 pivotally captures at a pivot 799 a branch 797A of a blade arm 797. A tab 779 is fixed to the branch 797A adjacent the pivot 799 and extends downwardly in a direction normal to the branch 797A. The tab 779 contacts a shaft-end 787A of the drive shaft 787 opposite the offset handle 794 and extending beyond the carrier 789. The branch 797A extends outwardly from the pivot 799 in a normal direction to the carrier arm 790 and couples to the blade arm 797 at an end opposite the carrier arm 790. The blade arm 797 is generally arcuately shaped and extends downwardly from the branch 797A to connect to a superior blade 796 with a tissue retractor 798 extending therefrom. Because the pivot 799 is located above the superior blade 796, a lifting force is exerted on the superior blade 796 and ribs as a spreading force from the inferior blade 783 is transmitted to the superior blade 796 through the pivot 799.

Rotation of the offset handle 794, while holding the spreader handle 793 stationary, will thread the drive screw 787 through both the spreader handle 793 and the carrier 789, and thereby cause the drive screw 787 and carrier 789 to traverse the drive base 781 as well as causing the carrier 789 to traverse the drive screw 787 in the same direction. As a result, the carrier 789 traverses the drive base 781 at approximately two-times the speed that the carrier 789 traverses the drive screw 787 and thus, the length of the shaft-end 787A extending beyond the carrier 789 will increase or decrease at approximately one-half the speed at which the carrier 789 traverses the drive base 781. Therefore, as the offset handle 794 is rotated in a direction to spread the ribs, the ribs will be raised at a rate slower than they are spread as the superior blade 796 naturally rotates about the pivot 799 as the length of the shaft-end 787A extending beyond the carrier 789 decreases. Similarly, as the offset handle 794 is rotated in a direction to lower the offset ribs, the length of the shaft-end 787A will increase, at a rate slower than the rate at which the carrier 789 traverses the drive base 781. As the length of the shaft end 787A increases, it forces the tab 779, and thus the superior blade 797, to rotate in the counterclockwise direction around the pivot 799, and thereby further lowers the ribs. Because the carrier 789 traverses the drive base 781 at a faster rate than the shaft-end 787A increases, the distance between the blades 783 and 796 along the drive base 781 tends to decrease as the ribs are lowered;"

<p>111. The retractor according to claim 109 in which said adjustable support arm comprises</p>	
<p>a stanchion; and</p>	<p>See, e.g., page 45, line 3-page 46, line 21: " Turning to Figure 26, a ninth embodiment of the access platform 410 of the present invention is shown. The access platform 410 mounts to the table or rail via slides 438 and 440 that are locked in place by positioners 450 and 452. The slides 438 and 440 rotatably retain pinions 442 and 444 driven by levers 446 and 448 and slidably receive stanchion racks 430 and 432. The stanchion racks 430 and 432 include rack gears 434 and 436 that operably couple with pinions 442 and 444. The levers 446 and 448 are rotated to drive the pinions 442 and 444 along rack gears 434 and 436 to adjust the height of the stanchion racks 430 and 432 relative to the table or patient, or to vertically offset blades 470 and 472 relative to one another.</p> <p>A pinion housing 422 is slidably attached to the stanchion rack 432 towards its upper end. A rack 420 is attached at one end to stanchion rack 430 and is slidably received in the pinion housing 422. A pinion 424 driven by a lever 426 is rotatably retained in the pinion housing 422 and operably connected to the rack 420. The lever 426 is rotated to drive the pinion 424 along the rack 420 to spread apart the stanchion racks 430 and 432 and effectively a patient's ribs.</p> <p>Torsional members 460 and 462 are attached to the top of the stanchion racks 430 and 432. Blade arms 474 and 476 extend outwardly from torsional members and attach to the blades 470 and 472. The torsional members comprise inner hubs 461 and 465 rotatably received in and operably connected to outer hubs 463 and 467. Locking levers 464 and 466 lock the inner hubs 461 and 465 in place relative to the outer hubs 463 and 467.</p> <p>In operation, the access platform 410 is positioned such that the blades 470 and 472 can be inserted into an incision in a patient's chest and then attached to the blade arms 474 and 476. Once the blades 470 and 472 are positioned in the incision and attached to the blade arms 474 and 476, the lever 426 is rotated to spread the blades 470 and 472 and the patient's ribs apart. The blades 470 and 472 can be effectively offset by rotating the inner hubs 461 and 465 relative to the outer hubs 463 and 467. While the blades 470 and 472 are rotated, the stanchion racks 430 and 432 can be raised or lowered by rotating levers 486 and 488 to drive pinions 442 and 444. By raising or lowering the stanchion racks 430 and 432, the blades 470 and 472 can be effectively raised or lowered relative to one another to further offset the blades 470 and 472 relative to one another. A wrench 468 is utilized to rotate the inner hubs 461 and 465 relative to the outer hubs 463 and 467;"</p>

slide member for clamping and adjustably positioning said stanchion on a table or bar and to raise or lower said stanchion to vertically adjust said second blade relative to said first blade.

See, e.g., page 45, line 3-page 46, line 21: " Turning to Figure 26, a ninth embodiment of the access platform 410 of the present invention is shown. The access platform 410 mounts to the table or rail via slides 438 and 440 that are locked in place by positioners 450 and 452. The slides 438 and 440 rotatably retain pinions 442 and 444 driven by levers 446 and 448 and slidably receive stanchion racks 430 and 432. The stanchion racks 430 and 432 include rack gears 434 and 436 that operably couple with pinions 442 and 444. The levers 446 and 448 are rotated to drive the pinions 442 and 444 along rack gears 434 and 436 to adjust the height of the stanchion racks 430 and 432 relative to the table or patient, or to vertically offset blades 470 and 472 relative to one another.

A pinion housing 422 is slidably attached to the stanchion rack 432 towards its upper end. A rack 420 is attached at one end to stanchion rack 430 and is slidably received in the pinion housing 422. A pinion 424 driven by a lever 426 is rotatably retained in the pinion housing 422 and operably connected to the rack 420. The lever 426 is rotated to drive the pinion 424 along the rack 420 to spread apart the stanchion racks 430 and 432 and effectively a patient's ribs.

Torsional members 460 and 462 are attached to the top of the stanchion racks 430 and 432. Blade arms 474 and 476 extend outwardly from torsional members and attach to the blades 470 and 472. The torsional members comprise inner hubs 461 and 465 rotatably received in and operably connected to outer hubs 463 and 467. Locking levers 464 and 466 lock the inner hubs 461 and 465 in place relative to the outer hubs 463 and 467.

In operation, the access platform 410 is positioned such that the blades 470 and 472 can be inserted into an incision in a patient's chest and then attached to the blade arms 474 and 476. Once the blades 470 and 472 are positioned in the incision and attached to the blade arms 474 and 476, the lever 426 is rotated to spread the blades 470 and 472 and the patient's ribs apart. The blades 470 and 472 can be effectively offset by rotating the inner hubs 461 and 465 relative to the outer hubs 463 and 467. While the blades 470 and 472 are rotated, the stanchion racks 430 and 432 can be raised or lowered by rotating levers 486 and 488 to drive pinions 442 and 444. By raising or lowering the stanchion racks 430 and 432, the blades 470 and 472 can be effectively raised or lowered relative to one another to further offset the blades 470 and 472 relative to one another. A wrench 468 is utilized to rotate the inner hubs 461 and 465 relative to the outer hubs 463 and 467;"

112. The retractor according to claim 111 including means for pivotally mounting said second blade on spreader member..

See, e.g., page 48, lines 1-11: "Turning to Figure 28, an eleventh embodiment of the access platform 651 comprises a spreader housing 602 that includes a drive mechanism therein (not shown) and a drive slot 608 formed therein. A spreader lever 604 is mounted on top of the spreader housing 602 and is operably connected to the drive mechanism housed therein. An inferior blade 650 is interconnected to the drive mechanism via a blade arm 640 which extends outwardly to the inferior blade 650 from the spreader housing 602 in a direction generally normal to the housing 602. A tissue retractor 670 is attached to the blade 650 to assist in tissue retraction;"

page 51, line 10-page 52, line 20: " Turning to Figure 30, a thirteenth embodiment of the access platform 655 of the present invention comprises a generally elongated drive base 601 having a blade arm 640 and a pad arm 683 extending therefrom. The blade arm 640 extends in a generally normal direction from the drive base 601, while the pad arm 683, which is generally arcuately shaped, extends longitudinally and downwardly from the drive base 601. The pad arm 683 terminates in a sternal pad 681. A threaded shaft carrier 607 extends upwardly from the drive base 601 adjacent the blade arm 640. An inferior blade 650 having a tissue retractor 670 extending therefrom attaches to the blade arm 640. In a preferred construction, the inferior blade 650, tissue retractor 670, blade arm 640, threaded shaft carrier 607, drive base 601, pad arm 683, and sternal pad 681 are formed from one-piece construction.

A hollow threaded shaft 603 is threaded through the shaft carrier 607 and extends along the drive base 601 to rotatably attach to a hollow drive block 609. A spreader handle 605 is attached to the shaft 603 at an end opposite the drive block 609. A worm gear 697 positioned in the drive block 609, is fixed to the end of a shaft 696 that passes through the hollow threaded shaft 603 and attaches to an offset handle 695 beyond the spreader handle 605. The worm gear 697 is operably connected to an arcuate worm gear rack 698 that is positioned within the drive block 609 and connected to a branch 643 of a blade arm 642. The branch 643 of the blade arm 642 extends from the blade arm 642 in a normal direction and is pivotally mounted to the hollow drive block 609. The blade arm 642 extends downwardly from the branch 643 and attaches to a superior blade 652 with a tissue retractor 672 extending therefrom. A follower 619 extends downwardly from the base of the hollow drive block 609 and is received in a elongated drive slot 611 in the drive base 601. As the drive block 609 is transversely driven along the base 601 by the threaded shaft 603, the follower 609 slidably follows the drive slot 611 in the drive base 601;"

page 54, line 16-page 55, line 19: "Referring to Figures 31 and 32, a fourteenth embodiment of the access platform 610 of the present invention comprises a spreader component 612 that includes a rack 613, a spreader base 614 attached to one end of the rack 613 and a pinion housing 620 slidably received over the rack 613. A pinion 621 that is driven by a lever 622 is rotatably retained in the pinion housing 620 and operably connected to the rack 613.

A fixed pivot 616 having a socket 618 formed therein, extends from the spreader base 614. A fixed pivot lock 615 with a lock screw 617 is fixedly connected to the fixed pivot 616. A moveable pivot 624 having a socket 625 formed therein, extends from the housing 620. Rotatably and releasably received in and extending from the sockets 618 and 625 are stem portions 644 and 646 of a pair of blade arms 640 and 642, respectively. The stem 644 that is received in the socket 618 of the fixed pivot 616 includes a stop 645 formed on its exterior to abut the fixed pivot lock 615 and stop the travel of the stem 644. Branch portions 641 and 643 of the blade arms 640 and 642 extend downwardly from the stem portions 644 and 646 and attach to inferior and superior blades 650 and 652, respectively. The superior blade 652 which is advantageously located below and interconnected to the moveable pivot 624, comprises a recessed throat 654 to capture a rib adjacent to an incision in the patient's chest cavity and a pair of elongated vanes 656 and 657 used to offset a plurality of the patient's ribs. The inferior blade 650 which is interconnected to the fixed pivot 616 comprises a recessed throat 653 used to capture a rib adjacent to an incision in the patient's chest cavity;"

page 56, lines 3-13: " The branch portion 643 of the blade arm 642 that is interconnected to the moveable pivot 624 extends higher vertically than the branch portion 641 of the blade arm 640 that is interconnected to the fixed pivot 616 when the blades 650 and 652 are substantially level (see Figure 29). This construction tends to increase the moment about the moveable pivot 624 caused by the offset of the movable pivot from the center-of-effort of the spreading force at the blades 650 and 652. Because the movable pivot 624 is located above the superior blade 652, a lifting force is naturally exerted on the superior blade 652 and ribs as spreading occurs;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 64, line 5-page 67, line 5: " Referring to Figure 39, a sixteenth embodiment of an access platform 780 comprises a generally elongated drive base 781 having a blade arm 782 extended generally in a normal direction from the drive base 781. A generally arcuate pad arm 786 extends generally longitudinally and downwardly from the drive base 781 and terminates at a sternal pad 785. A bearing support 791 extends upwardly from the drive base 781 adjacent the blade arm 782. An inferior blade 783 having a tissue retractor 784 extending therefrom attaches to the end of the inferior blade arm 782. In a preferred construction, the inferior blade 781, tissue retractor 784, blade arm 782, bearing support 791, drive base 781, pad arm 786 and sternal pad 785 are formed from one-piece construction.

A bearing 792 is mounted to the bearing support 791 and has a spreader handle 793 operably coupled thereto. A drive screw 787 having an offset handle 794 with a lever 795 attached to its first end, is threaded through the spreader handle 793 and freely passes through the bearing 792 and bearing support 791. The drive screw 787 extends longitudinally along the drive base 781 and is threaded through a carrier mount 789. The spreader handle 793 and the carrier mount 789 include oppositely wound threads. Rotation of the spreader handle 793 transversely drives the drive screw 787 and the carrier mount 789 mounted thereon along the drive base 781 and, thus, spreads or closes the blades 783 and 796. The carrier mount 789 includes a follower extending downwardly from its base that inserts into a drive slot 788 in the base 781. As the carrier mount 789 is translated across the drive base 781, the follower slides along the drive slot 788.

Extending upwardly and longitudinally outwardly in a direction away from the spreader handle 793, a carrier arm 790 extends from the carrier 789. At an end opposite the carrier mount 789, the carrier arm 790 pivotally captures at a pivot 799 a branch 797A of a blade arm 797. A tab 779 is fixed to the branch 797A adjacent the pivot 799 and extends downwardly in a direction normal to the branch 797A. The tab 779 contacts a shaft-end 787A of the drive shaft 787 opposite the offset handle 794 and extending beyond the carrier 789. The branch 797A extends outwardly from the pivot 799 in a normal direction to the carrier arm 790 and couples to the blade arm 797 at an end opposite the carrier arm 790. The blade arm 797 is generally arcuately shaped and extends downwardly from the branch 797A to connect to a superior blade 796 with a tissue retractor 798 extending therefrom. Because the pivot 799 is located above the superior blade 796, a lifting force is exerted on the superior blade 796 and ribs as a spreading force from the inferior blade 783 is transmitted to the superior blade 796 through the pivot 799.

Rotation of the offset handle 794, while holding the spreader handle 793 stationary, will thread the drive screw 787 through both the spreader handle 793 and the carrier 789, and thereby cause the drive screw 787 and carrier 789 to traverse the drive base 781 as well as causing the carrier 789 to traverse the drive screw 787 in the same direction. As a result, the carrier 789 traverses the drive base 781 at approximately two-times the speed that the carrier 789 traverses the drive screw 787 and thus, the length of the shaft-end 787A extending beyond the carrier 789 will increase or decrease at approximately one-half the speed at which the carrier 789 traverses the drive base 781. Therefore, as the offset handle 794 is rotated in a direction to spread the ribs, the ribs will be raised at a rate slower than they are spread as the superior blade 796 naturally rotates about the pivot 799 as the length of the shaft-end 787A extending beyond the carrier 789 decreases. Similarly, as the offset handle 794 is rotated in a direction to lower the offset ribs, the length of the shaft-end 787A will increase, at a rate slower than the rate at which the carrier 789 traverses the drive base 781. As the length of the shaft end 787A increases, it forces the tab 779, and thus the superior blade 797, to rotate in the counterclockwise direction around the pivot 799, and thereby further lowers the ribs. Because the carrier 789 traverses the drive base 781 at a faster rate than the shaft-end 787A increases, the distance between the blades 783 and 796 along the drive base 781 tends to decrease as the ribs are lowered;"

page 70, line 3-page 71, line 10: "Turning to Figure 40, a seventeenth embodiment of the access platform 800 comprises a spreader housing 801 which includes a drive mechanism housed therein (not shown) and a drive slot 803 cut into the spreader housing 801. A spreader lever 802 is mounted on the top of the spreader housing 801 and is operably connected to the drive mechanism housed therein. An inferior blade 805 having a tissue retractor 804 extending therefrom, is interconnected to the drive mechanism via a blade arm 806. The blade arm 806 extends outwardly from the spreader housing 801 in a generally normal direction.

A pad arm 817 connects at one end, or is formed integrally therewith, to the spreader housing 801 and extends outwardly therefrom. A sternal pad 816 is integrally formed on the pad arm 817 at an end opposite the housing 801. The pad arm 817 is generally arcuate to conform to an extended rib cage due to the offset of the ribs.

A superior blade 820 having a tissue retractor 821 extending therefrom, is connected to the bottom end of a generally arcuately shaped blade arm 818. The top end of the blade arm 818 is pivotally mounted on an offset stanchion 815 that extends upwardly from the pad arm 817. A compression member 813 is pivotally connected to the top of the stanchion 815 at pivot 814 and extends inwardly from the stanchion 815 toward the lever 802 on the spreader housing 801. An offset screw 811 having a handle 812 attached to its top end, is threaded through the compression member 813 at an end opposite the pivot 814 and is rotatably captured by a bushing assembly 808 rotatably coupled to a mount 807 that extends upwardly from the spreader housing 801. A counter-lift tab 809 extends inwardly from the blade arm 818 adjacent the stanchion 815. The lift tab 809 is operably connected to the compression member 813 through an offset spring 810 mounted therebetween;"

113. The retractor according to claim 106 in which said second blade is self-adjusting.

See, e.g., page 54, line 16-page 55, line 19: "Referring to Figures 31 and 32, a fourteenth embodiment of the access platform 610 of the present invention comprises a spreader component 612 that includes a rack 613, a spreader base 614 attached to one end of the rack 613 and a pinion housing 620 slidably received over the rack 613. A pinion 621 that is driven by a lever 622 is rotatably retained in the pinion housing 620 and operably connected to the rack 613.

A fixed pivot 616 having a socket 618 formed therein, extends from the spreader base 614. A fixed pivot lock 615 with a lock screw 617 is fixedly connected to the fixed pivot 616. A moveable pivot 624 having a socket 625 formed therein, extends from the housing 620. Rotatably and releasably received in and extending from the sockets 618 and 625 are stem portions 644 and 646 of a pair of blade arms 640 and 642, respectively. The stem 644 that is received in the socket 618 of the fixed pivot 616 includes a stop 645 formed on its exterior to abut the fixed pivot lock 615 and stop the travel of the stem 644. Branch portions 641 and 643 of the blade arms 640 and 642 extend downwardly from the stem portions 644 and 646 and attach to inferior and superior blades 650 and 652, respectively. The superior blade 652 which is advantageously located below and interconnected to the moveable pivot 624, comprises a recessed throat 654 to capture a rib adjacent to an incision in the patient's chest cavity and a pair of elongated vanes 656 and 657 used to offset a plurality of the patient's ribs. The inferior blade 650 which is interconnected to the fixed pivot 616 comprises a recessed throat 653 used to capture a rib adjacent to an incision in the patient's chest cavity;"

page 56, lines 3-13: " The branch portion 643 of the blade arm 642 that is interconnected to the moveable pivot 624 extends higher vertically than the branch portion 641 of the blade arm 640 that is interconnected to the fixed pivot 616 when the blades 650 and 652 are substantially level (see Figure 29). This construction tends to increase the moment about the moveable pivot 624 caused by the offset of the movable pivot from the center-of-effort of the spreading force at the blades 650 and 652. Because the movable pivot 624 is located above the superior blade 652, a lifting force is naturally exerted on the superior blade 652 and ribs as spreading occurs;"

page 58, line 6-page 59, line 24: "In operation, the blades 650 and 652 are inserted in an incision in the patient's chest such that the elongated vanes 656 and 657 of the blade 652 are positioned under the patient's ribs while the recessed throats 653 and 654 of the blades 650 and 652 are positioned to receive the ribs that are adjacent to the incision. After the blades 650 and 652 are properly positioned, the stem 644 of the blade arm 640 is inserted through the fixed pivot lock 615 into the socket 618 of the fixed pivot 616. Meanwhile, the stem 646 of the blade arm 642 is inserted through the moveable pivot lock 626 and the end of the shoe arm 682 opposite the shoe 680, and into the socket 625 of the moveable pivot 624. The blade 650 is then fixed in position by tightening the fixed pivot lock screw 617 to tighten the fixed pivot lock 615 around the stem 644 of the blade arm 640.

The rib compression shoe 680 is then adjusted downwardly by adjusting the adjustable offset drive screw 636 until the desired compression of the ribs is achieved. The blade 652 that is interconnected to the moveable pivot 624 is then fixed in position relative to the shoe 680 by tightening the moveable pivot lock screw 627 to tighten the moveable pivot lock 626 around the stem 646 of the blade arm 642. The ribs are then separated and simultaneously offset by rotating the lever 622 to drive the pinion 621 along the rack 613 until a desired opening width is realized. Because the movable pivot 624 is advantageously located above the blade 652, the superior blade 652 naturally raises vertically as it rotates about the moveable pivot 624 as a spreading force from the inferior blade 650 is transmitted to the superior blade 652 through the movable pivot 624.

Further adjustment of an offset height of the superior blades 652 may be obtained by first loosening the moveable pivot lock 626 around the stem 646 of the blade arm 642 and then adjusting the adjustable offset drive screw 636 to cause the shoe 680 and the shoe arm 682 to rotate downwardly in a clockwise direction relative to the superior blade 652 and, thus, cause the blade 652 that is interconnected to the moveable pivot 624 to rise vertically until a desired offset is achieved. Alternatively, the blade arm 642 would remain fixed to the shoe arm 682 as the offset drive screw 636 is adjusted to cause the shoe 680 and shoe arm 682 to rotate downwardly in a clockwise direction. The clockwise rotation of the shoe 680 and shoe arm 682 causes the blade 652 to rotate upwardly in a clockwise direction;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 70, line 3-page 71, line 10: "Turning to Figure 40, a seventeenth embodiment of the access platform 800 comprises a spreader housing 801 which includes a drive mechanism housed therein (not shown) and a drive slot 803 cut into the spreader housing 801. A spreader lever 802 is mounted on the top of the spreader housing 801 and is operably connected to the drive mechanism housed therein. An inferior blade 805 having a tissue retractor 804 extending therefrom, is interconnected to the drive mechanism via a blade arm 806. The blade arm 806 extends outwardly from the spreader housing 801 in a generally normal direction.

A pad arm 817 connects at one end, or is formed integrally therewith, to the spreader housing 801 and extends outwardly therefrom. A sternal pad 816 is integrally formed on the pad arm 817 at an end opposite the housing 801. The pad arm 817 is generally arcuate to conform to an extended rib cage due to the offset of the ribs.

A superior blade 820 having a tissue retractor 821 extending therefrom, is connected to the bottom end of a generally arcuately shaped blade arm 818. The top end of the blade arm 818 is pivotally mounted on an offset stanchion 815 that extends upwardly from the pad arm 817. A compression member 813 is pivotally connected to the top of the stanchion 815 at pivot 814 and extends inwardly from the stanchion 815 toward the lever 802 on the spreader housing 801. An offset screw 811 having a handle 812 attached to its top end, is threaded through the compression member 813 at an end opposite the pivot 814 and is rotatably captured by a bushing assembly 808 rotatably coupled to a mount 807 that extends upwardly from the spreader housing 801. A counter-lift tab 809 extends inwardly from the blade arm 818 adjacent the stanchion 815. The lift tab 809 is operably connected to the compression member 813 through an offset spring 810 mounted therebetween;"

page 86, line 9-page 87, line 17: " Referring to Figures 66-70, a self-aligning access platform 260 comprises blades 261 and 262 that are mounted to blade arms 263 and 264, respectively, and include tissue retractors 280 and 281 extending therefrom. The blade arms 263 and 264 are pivotally connected at a pivot 275 and driven apart or together by a drive mechanism 278. The drive mechanism 278 includes a handle 279 operably coupled to a lead screw 277. First and second links 272 and 273 are pivotally coupled to the blade arms 263 and 264, respectively, and a drive block 276 threadably carried on the lead screw 277.

The blade arms 263 and 264 comprise a branch (shown at 265 in Figure 68) that extends upwardly from the blades 261 and 262 to an elbow (shown at 282 in Figure 68) where the blade arms 263 and 264 bend and extend away from the blades 261 and 262. The blade arms 263 and 264 narrow down to a thin section at flexures 289 and 290 adjacent the blade arm elbows. Thin elongated tension members 266 and 267 extend between the drive member 278 and the blade arm elbows in a spaced relation with the blade arms 263 and 264. The tension members 266 and 267 include knuckles 268 and 269 coupled to the blade arms 263 and 264 at pivots 270 and 274. Thin flexures 288 and 291 are formed at the intersection between the tension members 266 and 267 and the blade arm elbows. As the drive member is operated to spread the ribs apart, the blades 261 and 262 will advantageously flex about flexures 288 and 289 and 290 and 291, respectively, to compensate for the alignment of the blade arms 263 and 264 relative to the retracted ribs.

Alternatively, blades 261 and 262 are coupled to the blade arms 263 and 264 which have V-shaped mounts 286 and 287 with opposing flexures 288 and 289, 290 and 291, respectively. As the ribs are separated, the blades 261 and 262 will flex at flexures 288, 289, 290 and 291 and, thus, advantageously apply a force at the center of effort through the flexures 288, 289, 290 and 291;"

114. The retractor according to claim 113 including mounting means mounting said self-adjusting second blade so that said second blade swings freely relative to said spreader member.

See, e.g., page 54, line 16-page 55, line 19: "Referring to Figures 31 and 32, a fourteenth embodiment of the access platform 610 of the present invention comprises a spreader component 612 that includes a rack 613, a spreader base 614 attached to one end of the rack 613 and a pinion housing 620 slidably received over the rack 613. A pinion 621 that is driven by a lever 622 is rotatably retained in the pinion housing 620 and operably connected to the rack 613.

A fixed pivot 616 having a socket 618 formed therein, extends from the spreader base 614. A fixed pivot lock 615 with a lock screw 617 is fixedly connected to the fixed pivot 616. A moveable pivot 624 having a socket 625 formed therein, extends from the housing 620. Rotatably and releasably received in and extending from the sockets 618 and 625 are stem portions 644 and 646 of a pair of blade arms 640 and 642, respectively. The stem 644 that is received in the socket 618 of the fixed pivot 616 includes a stop 645 formed on its exterior to abut the fixed pivot lock 615 and stop the travel of the stem 644. Branch portions 641 and 643 of the blade arms 640 and 642 extend downwardly from the stem portions 644 and 646 and attach to inferior and superior blades 650 and 652, respectively. The superior blade 652 which is advantageously located below and interconnected to the moveable pivot 624, comprises a recessed throat 654 to capture a rib adjacent to an incision in the patient's chest cavity and a pair of elongated vanes 656 and 657 used to offset a plurality of the patient's ribs. The inferior blade 650 which is interconnected to the fixed pivot 616 comprises a recessed throat 653 used to capture a rib adjacent to an incision in the patient's chest cavity;"

page 56, lines 3-13: " The branch portion 643 of the blade arm 642 that is interconnected to the moveable pivot 624 extends higher vertically than the branch portion 641 of the blade arm 640 that is interconnected to the fixed pivot 616 when the blades 650 and 652 are substantially level (see Figure 29). This construction tends to increase the moment about the moveable pivot 624 caused by the offset of the movable pivot from the center-of-effort of the spreading force at the blades 650 and 652. Because the movable pivot 624 is located above the superior blade 652, a lifting force is naturally exerted on the superior blade 652 and ribs as spreading occurs;"

page 58, line 6-page 59, line 24: "In operation, the blades 650 and 652 are inserted in an incision in the patient's chest such that the elongated vanes 656 and 657 of the blade 652 are positioned under the patient's ribs while the recessed throats 653 and 654 of the blades 650 and 652 are positioned to receive the ribs that are adjacent to the incision. After the blades 650 and 652 are properly positioned, the stem 644 of the blade arm 640 is inserted through the fixed pivot lock 615 into the socket 618 of the fixed pivot 616. Meanwhile, the stem 646 of the blade arm 642 is inserted through the moveable pivot lock 626 and the end of the shoe arm 682 opposite the shoe 680, and into the socket 625 of the moveable pivot 624. The blade 650 is then fixed in position by tightening the fixed pivot lock screw 617 to tighten the fixed pivot lock 615 around the stem 644 of the blade arm 640.

The rib compression shoe 680 is then adjusted downwardly by adjusting the adjustable offset drive screw 636 until the desired compression of the ribs is achieved. The blade 652 that is interconnected to the moveable pivot 624 is then fixed in position relative to the shoe 680 by tightening the moveable pivot lock screw 627 to tighten the moveable pivot lock 626 around the stem 646 of the blade arm 642. The ribs are then separated and simultaneously offset by rotating the lever 622 to drive the pinion 621 along the rack 613 until a desired opening width is realized. Because the movable pivot 624 is advantageously located above the blade 652, the superior blade 652 naturally raises vertically as it rotates about the moveable pivot 624 as a spreading force from the inferior blade 650 is transmitted to the superior blade 652 through the movable pivot 624.

Further adjustment of an offset height of the superior blades 652 may be obtained by first loosening the moveable pivot lock 626 around the stem 646 of the blade arm 642 and then adjusting the adjustable offset drive screw 636 to cause the shoe 680 and the shoe arm 682 to rotate downwardly in a clockwise direction relative to the superior blade 652 and, thus, cause the blade 652 that is interconnected to the moveable pivot 624 to rise vertically until a desired offset is achieved. Alternatively, the blade arm 642 would remain fixed to the shoe arm 682 as the offset drive screw 636 is adjusted to cause the shoe 680 and shoe arm 682 to rotate downwardly in a clockwise direction. The clockwise rotation of the shoe 680 and shoe arm 682 causes the blade 652 to rotate upwardly in a clockwise direction;"

page 61, line 1-page 62, line 16: "A fifteenth embodiment of an access platform 700 of the present invention, as shown in Figures 33 and 34, comprises an elongated spreader housing 702 with a block and tackle type drive mechanism 970 located therein (see Figures 35-38 discussed in detail below). A lever 701 interconnected to the drive mechanism 970 extends upwardly from the spreader housing 702. A blade arm 705 connected to an inferior blade 706 is mounted to a base 704 fixedly received in the housing 702. The blade arm 705 extends outwardly and then downwardly from the spreader housing 702 to the inferior blade 706. The inferior blade 706 includes a tissue retractor 707 extending therefrom.

A drive block 708 coupled to the drive mechanism 970 in the spreader housing 702, extends outwardly from the spreader housing 702 in a normal direction to the housing 702. As the lever 701 is rotated, the drive mechanism 970 slidably carries the drive block 708 along the drive slot 703 of the spreader housing 702.

A blade arm 711 is attached at its lower end to a superior blade 712 with a tissue retractor 713 extending therefrom. At its upper end, the blade arm 711 is rotatably coupled to an upper end of an elongated arcuate pad arm 715. The pad arm 715 is attached at its lower end to a sternal pad 714. The upper end of the pad arm 715 forms a forked hub 716. The blade arm 711, pad arm 715 and sternal pad 714 assembly is releasably and rotatably mounted on a cylindrical shaft 710 attached to the drive block 708.

The access platform 700 incorporates an offset positioning assembly 717 that comprises a pawl 719 pivotally mounted in a recess 723 of the pad arm 715 at a pivot 722 and a ratchet 718 formed on the upper end of the blade arm 711. The pawl 719 includes a pawl nose 721 that engages the ratchet 718 and a pawl lever 720 that is depressed to pivot the pawl 719 about pivot 722 to disengage the pawl nose 721 from the ratchet 718. With the pawl nose 721 engaged, the pad arm 715 can only rotate in a clockwise direction relative to the blade arm 711. The pawl 719 prevents the hub 716 of the arm 715 from rotating in a counterclockwise direction relative to the blade arm 711. With the pawl nose 721 disengaged from the ratchet 718, the pad arm 715 can freely rotate relative to the blade arm 711 in a counterclockwise direction;"

page 70, line 3-page 71, line 10: "Turning to Figure 40, a seventeenth embodiment of the access platform 800 comprises a spreader housing 801 which includes a drive mechanism housed therein (not shown) and a drive slot 803 cut into the spreader housing 801. A spreader lever 802 is mounted on the top of the spreader housing 801 and is operably connected to the drive mechanism housed therein. An inferior blade 805 having a tissue retractor 804 extending therefrom, is interconnected to the drive mechanism via a blade arm 806. The blade arm 806 extends outwardly from the spreader housing 801 in a generally normal direction.

A pad arm 817 connects at one end, or is formed integrally therewith, to the spreader housing 801 and extends outwardly therefrom. A sternal pad 816 is integrally formed on the pad arm 817 at an end opposite the housing 801. The pad arm 817 is generally arcuate to conform to an extended rib cage due to the offset of the ribs.

A superior blade 820 having a tissue retractor 821 extending therefrom, is connected to the bottom end of a generally arcuately shaped blade arm 818. The top end of the blade arm 818 is pivotally mounted on an offset stanchion 815 that extends upwardly from the pad arm 817. A compression member 813 is pivotally connected to the top of the stanchion 815 at pivot 814 and extends inwardly from the stanchion 815 toward the lever 802 on the spreader housing 801. An offset screw 811 having a handle 812 attached to its top end, is threaded through the compression member 813 at an end opposite the pivot 814 and is rotatably captured by a bushing assembly 808 rotatably coupled to a mount 807 that extends upwardly from the spreader housing 801. A counter-lift tab 809 extends inwardly from the blade arm 818 adjacent the stanchion 815. The lift tab 809 is operably connected to the compression member 813 through an offset spring 810 mounted therebetween;"